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Work Plan for a
Treatability Study in Support of the
Intrinsic Remediation (Natural Attenuation) Option at
The BX Shoppette (Site E11)



Eaker Air Force Base Blytheville, Arkansas

Prepared For

Air Force Center for Environmental Excellence Technology Transfer Division Brooks Air Force Base San Antonio, Texas

and

Air Force Base Conversion Agency/OL-J Eaker Air Force Base Blytheville, Arkansas

January 1996

AQM01-01-0358

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WORK PLAN FOR A TREATABILITY STUDY IN SUPPORT OF INTRINSIC REMEDIATION (NATURAL ATTENUATION) OPTION AT THE BX SHOPPETTE (SITE E11)

EAKER AIR FORCE BASE BLYTHEVILLE, ARKANSAS

January 1996

Prepared for:

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
TECHNOLOGY TRANSFER DIVISION
BROOKS AIR FORCE BASE
SAN ANTONIO, TEXAS

and

AIR FORCE BASE CONVERSION AGENCY/OL-J EAKER AIR FORCE BASE BLYTHEVILLE, ARKANSAS

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SECTION 1

INTRODUCTION

This work plan, prepared by Parsons Engineering Science, Inc. (Parsons ES), presents the scope of work required for the collection of data necessary to conduct a treatability study (TS) for remediation of groundwater contaminated with petroleum hydrocarbons at the Base Exchange (BX) Shoppette underground storage tank site (Site E11) located at Eaker Air Force Base (AFB) (the Base), near the city of Blytheville, Arkansas. Several groundwater remedial options will be evaluated as a part of the TS report, including: active bioremediation (i.e., air sparging and bioventing); groundwater extraction, treatment, and disposal (i.e., pump and treat); and natural contaminant attenuation (intrinsic remediation) with long-term monitoring. Hydrogeologic and groundwater chemical data necessary to evaluate the various remedial options will be collected under this program; however, this work plan is oriented toward the collection of hydrogeologic data to be used as input into groundwater flow and solute transport models in support of intrinsic remediation for restoration of groundwater contaminated with benzene, toluene, ethylbenzene, and xylene (BTEX).

As used in this report, the term "intrinsic remediation" refers to a management strategy that relies on natural attenuation mechanisms to remediate contaminants dissolved in groundwater and to control receptor exposure risks associated with contaminants in the subsurface. "Natural attenuation" refers to the actual physical, chemical, and biological processes that facilitate intrinsic remediation. Mechanisms for natural attenuation of BTEX include biodegradation, advection, dispersion, dilution from recharge, sorption, and volatilization. Of these processes, biodegradation is the only mechanism working to

transform contaminants into innocuous byproducts. Intrinsic bioremediation occurs when indigenous microorganisms work to bring about a reduction in the total mass of contamination in the subsurface without the addition of nutrients. Patterns and rates of intrinsic remediation can vary markedly from site to site depending on governing physical and chemical processes.

As part of the TS, the contaminant fate and transport modeling effort has three primary objectives: 1) predict the future extent and concentration of dissolved contaminant plumes by modeling the effects of advection, dispersion, sorption, and biodegradation; 2) assess the possible exposure of potential downgradient receptors to contaminant concentrations that exceed levels intended to be protective of human health and the environment; and 3) provide technical support for selection of the intrinsic remediation option as the best remedial alternative at regulatory negotiations, as appropriate. The modeling efforts for the BX Shoppette at Eaker AFB will involve completion of several tasks, which are described in the following sections.

This work plan was developed following discussions among representatives from the Air Force Center for Environmental Excellence (AFCEE), Air Force Base Conversion Agency (AFBCA), and Parsons ES at a meeting held at the Base on November 16, 1995, the statement of work (SOW) for this project, and on a review of existing site characterization data. All field work will follow the health and safety procedures presented in the program *Health and Safety Plan for Bioplume II Modeling Initiative* (Engineering Science, Inc., 1993), and the site-specific addendum to the program Health and Safety Plan. This work plan was prepared for AFCEE and AFBCA.

1.1 SCOPE OF CURRENT WORK PLAN

The ultimate objective of the work described herein is to provide a TS for remediation of hydrocarbon groundwater contamination at the BX Shoppette. However, this project is part of a larger, broad-based initiative being conducted by AFCEE in conjunction with the US Environmental Protection Agency (USEPA) and Parsons ES to document the

biodegradation and resulting attenuation of fuel hydrocarbons and solvents dissolved in groundwater, and to model this degradation using numerical and analytical groundwater model codes. For this reason, the work described in this work plan is directed toward the collection of data in support of this initiative. Data sufficient to develop a 30-percent design of an alternate groundwater remediation system, should intrinsic remediation not prove to be a viable remedial option at this facility, also will be collected under this program. This work plan describes the site characterization activities to be performed by personnel from Parsons ES in support of the TS and the groundwater modeling effort. Field activities will be performed to determine the extent of mobile and residual light nonaqueous-phase liquid (LNAPL) at the site and to determine the extent of dissolved contamination. The data collected during the TS will be used along with data from previous investigations to complete the characterization of the site. These data will also be used in the groundwater flow and solute transport models to make predictions of the future concentrations and extent of contamination.

Site characterization activities in support of the TS will include: 1) determination of preferential contaminant migration and potential receptor exposure pathways; 2) soil sampling using cone penetrometer (CPT) direct-push technology; 3) groundwater monitoring point placement; 4) groundwater sampling; and 5) aquifer testing. The materials and methodologies to accomplish these activities are described herein. Previously reported site-specific data and data collected during the supplemental site characterization activities described in this work plan will be used as input for the groundwater flow and solute transport models. Where site-specific data are not available, conservative values for the types of aquifer materials present at the site will be obtained from widely accepted published literature and used for model input. Sensitivity analyses will be conducted for the parameters that are known to have the greatest influence on the model results, and where possible, the model will be calibrated using historical site data. Upon completion of the modeling, Parsons ES will provide technical assistance at regulatory negotiations to support the intrinsic remediation option if the results of the modeling indicate that this approach is warranted. If it is shown that intrinsic remediation

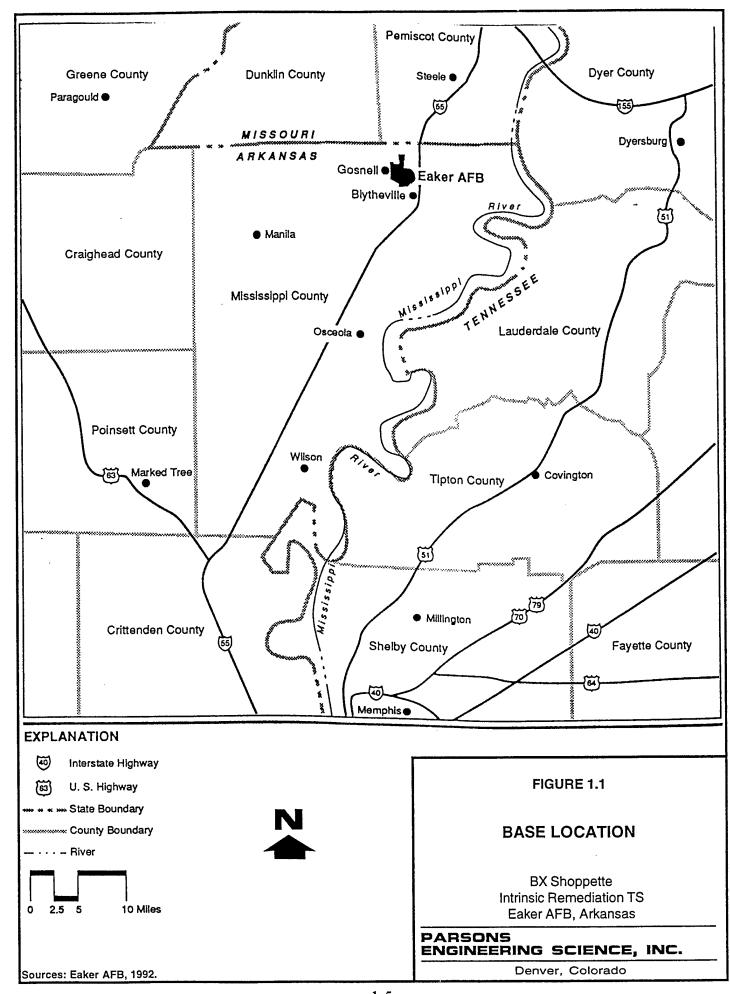
is not the most appropriate remedial option, Parsons ES will recommend the most appropriate groundwater remedial technology on the basis of available data.

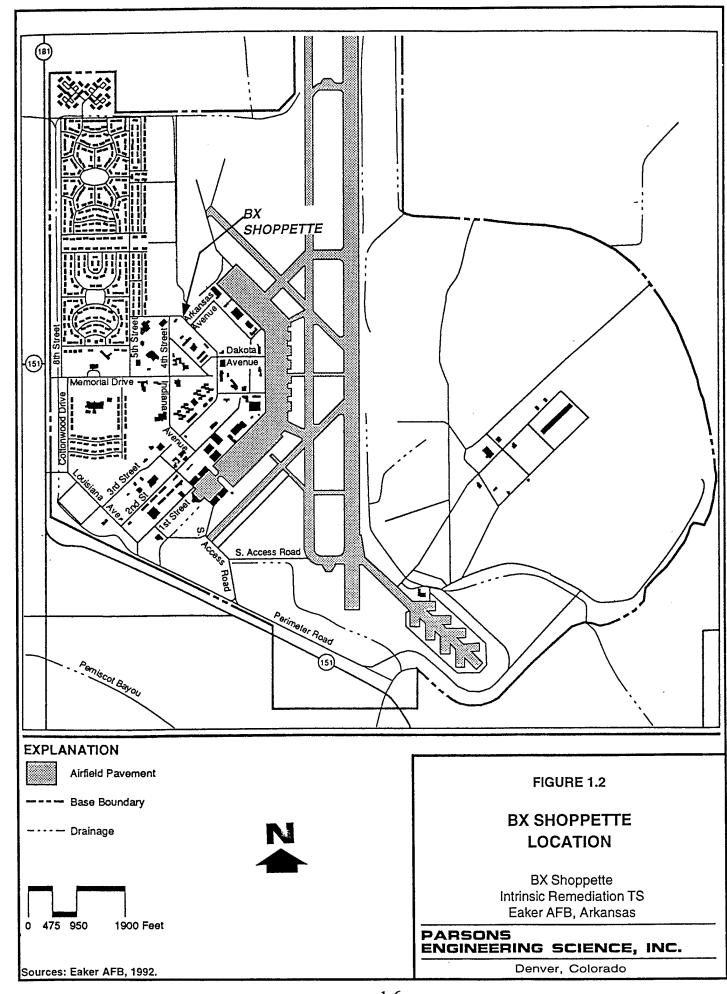
This work plan consists of six sections, including this introduction. Section 2 presents a review of available (previously reported) site-specific data, and conceptual models for the site. Section 3 describes the proposed sampling strategy and procedures to be used for the collection of additional site characterization data. Section 4 describes the remedial option evaluation procedure and TS report format. Section 5 describes the quality assurance/quality control (QA/QC) measures to be used during this project. Section 6 contains the references used in preparing this document. There are two appendices to this work plan. Appendix A contains a listing of containers, preservatives, packaging, and shipping requirements for soil and groundwater samples. Appendix B contains a summary of site data, including available well logs, and summaries of historical soil and groundwater analytical data from previous field investigations.

1.2 BACKGROUND

Eaker AFB is located in the northeastern corner of Arkansas, in Mississippi County, approximately 3 miles south of the Missouri state line and 11 miles east of the Tennessee state line. The Base occupies an area of approximately 3,300 acres 2 miles northwest of Blytheville, Arkansas and adjacent to the community of Gosnell (Figure 1.1). The Base is divided roughly in half by the main north/south runway (Figure 1.2). Aviation support, approximately 930 Base housing units, a hospital, and commercial facilities are located in the western portion of the Base. The eastern half of the Base is dedicated primarily to agricultural, recreational, and industrial activities. The predominant existing land use surrounding Eaker AFB is agricultural, with some residential parcels (Eaker AFB, 1992).

The Base was established in 1942 as the Blytheville Army Airfield and served as a training center until deactivation in 1945. From 1947 to 1955, the site was used for manufacturing, private housing, and as an airport. The Base was reactivated as Blytheville AFB in 1955 under the direction of the Tactical Air Command, and then

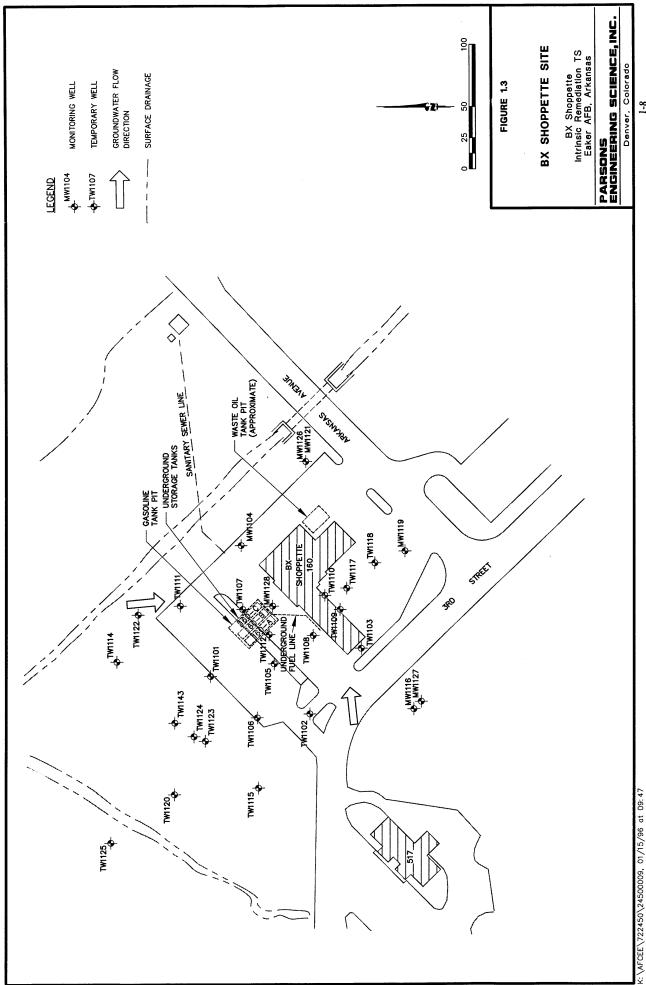




transferred to the Strategic Air Command (SAC) in 1958. The 97th Bombardment Wing assumed command of the Base until the disestablishment of SAC in 1992, when control was transferred to the Air Combat Command. In 1988, the Base was renamed Eaker AFB. Base operations in 1990 employed approximately 3,600 civilian and military personnel (Eaker AFB, 1992). In July 1991, the recommendation for base closure was approved and closure was scheduled for December, 1992.

The BX Shoppette site is located in the west-central portion of the base (Figure 1.2) and is bounded by open land to the north and west, and by base operations facilities to the east and south. Two 10,000-gallon USTs were installed at the site in 1969. The tanks (160-A and 160-B) contained regular unleaded gasoline and were steel-constructed, tar-coated, and corrosion protected by sacrificial anodes (cathodic protection). Two additional USTs (160-C and 160-D) were installed in 1971. Tank 160-C was steel-constructed, tar-coated, and cathodically protected. The tank capacity was 6,000 gallons. The tank originally contained regular leaded gasoline; however, the tank was converted to a premium unleaded gasoline tank in 1990. Tanks 160-A, -B, and -C are located within a gasoline tank pit, approximately 30 feet northwest of the BX Shoppette (Figure 1.3). Tank 160-D, a 1,000-gallon tank used to store waste oil, is located in the northeastern corner of the shoppette building (Figure 1.3). This tank is constructed of steel but is not cathodically protected (Halliburton NUS, 1994).

In 1974, a leak in the pipeline from the fuel USTs to the fuel dispensers was repaired. An unknown amount fuel was released prior to repair of the 1974 pipeline leak, and no hydrocarbon-contaminated soils were removed during the repair (Halliburton NUS, 1992). In December 1989, a tank tightness test was performed on the BX Shoppette USTs. Tank 160-A failed the tightness test and was subsequently deactivated in March 1990. In August 1990, a tank and line tightness test was performed on the remaining USTs and fuel dispensing system. This test indicated leaks in one of the 10,000-gallon USTs, the 6,000-gallon UST, and the waste oil tank. The tops of the tanks were exposed and isolated from their associated piping for retesting. All four tanks passed the retesting.



In February and June 1991 a total of 28 soil borings were installed by Professional Services, Inc. (PSI) (Halliburton NUS, 1992). These borings confirmed the presence hydrocarbons in the soil around the tank pit and identified free product in groundwater. Halliburton NUS (1992, 1994, and 1995) continued site investigation under the Installation Restoration Program (IRP) and collected additional soil samples, installed monitoring wells, and sampled site groundwater. The horizontal limits of soil BTEX contamination have been established, however the vertical extent of soil BTEX has not been defined. BTEX compounds have been detected in soil samples from 22 feet below ground surface (bgs) between the fuel tank pit and the BX Shoppette. Mobile LNAPL was up to 4 feet thick in an area southwest of the gasoline tank pit, as measured in May 1992. Groundwater is contaminated and may be preferentially migrating laterally along thin layers of silt and sand between clay layers. In February 1992, Eaker AFB personnel bailed a total of 10.75 gallons of free product from monitoring well TW1105. Other than this action, no product recovery has taken place (Halliburton NUS, 1994).

SECTION 2

DATA REVIEW AND CONCEPTUAL MODEL DEVELOPMENT

Previously reported site-specific data were reviewed and used to develop a conceptual site model (CSM) for the groundwater flow and contaminant transport conditions at the BX Shoppette. The CSM guides the selection of sampling locations and analytical data requirements needed to support the modeling efforts and to evaluate potential remediation technologies (including intrinsic remediation). Section 2.1 presents a synopsis of available site characterization data. Section 2.2 presents the preliminary conceptual groundwater flow and contaminant transport model that was developed based on these data.

2.1 DATA REVIEW

The following sections are based upon review of the following sources:

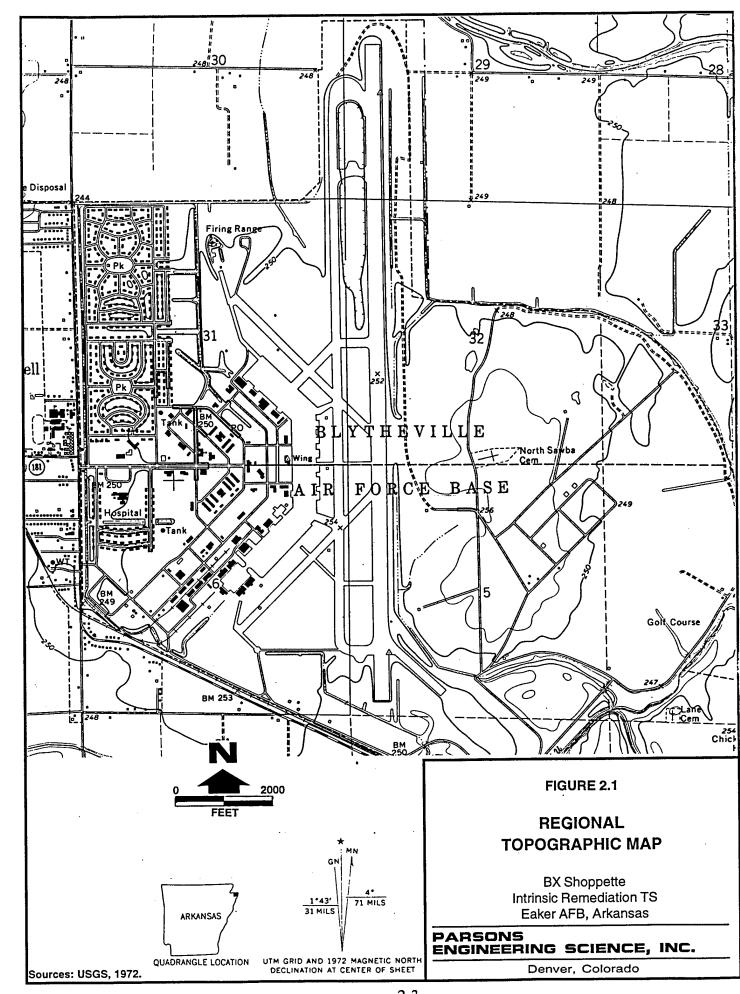
- Final Environmental Impact Statement Disposal and Reuse of Eaker Air Force Base, Arkansas (FEIS) (Eaker AFB, 1992);
- IRP Draft Site Assessment Report for the BX Shoppette Underground Storage
 Tank Site (Halliburton NUS, 1992),
- Unpublished site data (Halliburton NUS, 1994 and 1995); and

 Site Characterization and Analysis System (SCAPS) Report [US Army Corps of Engineers (USACE, 1995)].

2.1.1 Topography, Surface Hydrology, and Climate

Eaker AFB is located within the Mississippi Embayment of the Atlantic and Gulf Plains physiographic province (Eaker AFB, 1992), and lies within the eastern lowland portion of the Central Mississippi River Valley. The topography in the region is generally level except in areas adjacent to the Mississippi River. Ground surface elevations on the Base range from 245 feet above mean sea level (msl) at the southeastern end of the Base (in the vicinity of Pemiscot Bayou) to 265 feet msl at the northwestern end of the Base, near the firing range (Figure 2.1). At the BX Shoppette, the topography is flat and the ground surface elevation is approximately 250 feet msl.

Eaker AFB is located within the St. Francis River watershed of the Lower Mississippi River Basin. Surface water drainage is characteristic of the Mississippi River floodplain, and drainage ditches and bayous have been dredged in the flat terrain to accommodate surface water runoff. The majority of the Base lies above the level of the 100-year floodplain, and the potential for flooding is minimal. A combination of open drainage ditches and storm drains is used to capture and direct runoff from the Base (Eaker AFB, 1992). Stormwater runoff in the eastern portion of the Base drains to Pemiscot Bayou, while surface water flow on the western half of the Base drains to Ditch 25. Both of these drainage channels flow southwest to the Little River, which discharges into the St. Francis River. The St. Francis River discharges into the Mississippi River approximately 150 miles south of Eaker AFB. Surface water flow at the BX Shoppette discharges into the adjacent surface drainages which flow into Ditch Number 25, located approximately 4,000 feet north of the site.



The Eaker AFB climate is subtropical, with mild winters and hot, humid summers. July is the warmest month with an average maximum daily temperature of 90 degrees Fahrenheit (°F). The coolest month is January with an average minimum daily temperature of 28°F. The average annual precipitation is 48.3 inches, which is evenly distributed throughout the year. The average annual relative humidity is 69 percent. Flooding occurs during periods of prolonged heavy rainfall, and during the summer months climatic conditions make tornado formation possible (Eaker AFB, 1992).

2.1.2 Overview of Geology and Hydrogeology

2.1.2.1 Regional Geology and Hydrogeology

The shallow subsurface geology of northeastern Arkansas consists of Quaternary alluvium, which is thickest near the Mississippi River and thins in a westerly direction. The alluvium is composed of interbedded clays, silts, sand, and minor gravel and has an average thickness of 125 feet (Eaker AFB, 1992). The shallow, unconsolidated, Quaternary sediments on Eaker AFT are interpreted to be flood plain and channel deposits associated with the past and present positions of the Mississippi River (Halliburton NUS, 1992). The overlying soils are weathering products of the alluvial deposits and are generally nontransmissive, fine-grained, clayey soils. These soils impede infiltration and allow for rapid runoff of surface water.

Sediments in the vicinity of the Base consist of over 2,000 feet of Tertiary and Cretaceous unconsolidated deposits overlying Lower Paleozoic carbonate bedrock (Eaker AFB, 1992). The Tertiary Wilcox Formation is present approximately 900 feet below the Base. The lower part of this formation is composed of sands that produce potable water used by Eaker AFB, the city of Blytheville, and the city of Gosnell (Eaker AFB, 1992).

The aquifer is under confined conditions, and the water quality is excellent. Water treatment is required only to remove slightly elevated iron concentrations. The lower Wilcox Formation aquifer is protected from contamination by approximately 800 feet of interbedded unconsolidated sands and clays that form the Claiborne Group.

Shallow groundwater in the vicinity of the Base is present between 7 and 12 feet bgs and in the Quaternary alluvial sands. Irrigation wells and rural residences generally obtain water from these Quaternary sands (Eaker AFB, 1992). The upper part of the Quaternary deposits consists of sandy clay and clay, while the remainder of the deposits are sand and gravel. The sands and gravels comprise the major water-bearing units in the Quaternary deposits. Water from the alluvial aquifer is characterized as moderately hard to very hard hardness (as calcium bicarbonate). The water table is highest in the area northeast of the Base, indicating an area of surface recharge to the Quaternary sands and gravels (Eaker, 1992). Flood control for the Mississippi River and local flooding are responsible for some groundwater elevation fluctuation. Groundwater in the vicinity of Eaker AFB flows southwest to south.

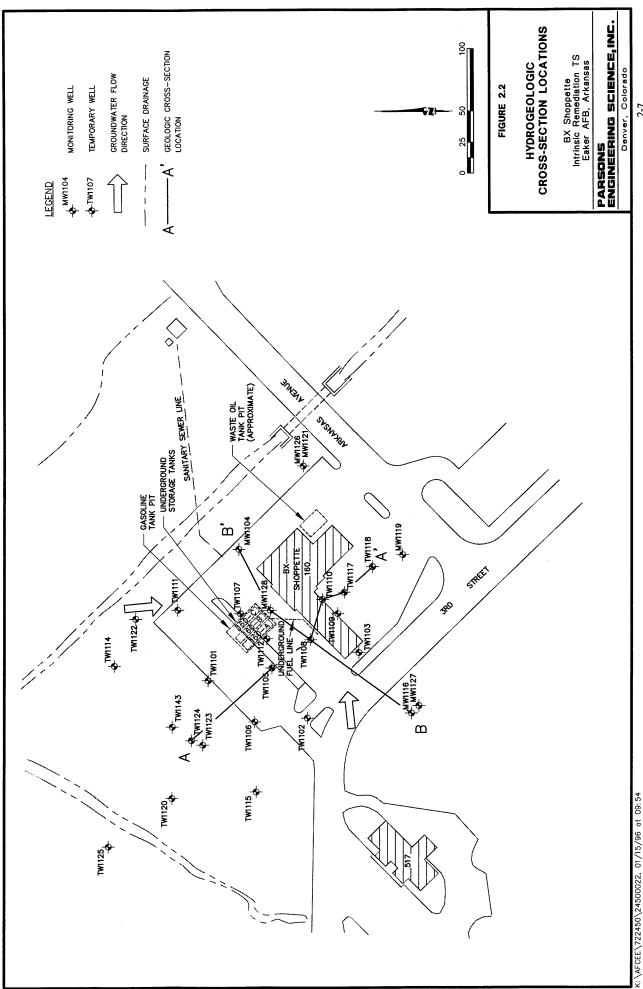
2.1.2.2 BX Shoppette Geology and Hydrology

Most of the ground surface at the BX Shoppette is covered by about 6 inches of asphalt pavement overlying approximately 2 to 4 feet of sandy fill material. On the basis of information collected during the previous investigations, the shallow alluvial sediments at the site consist primarily of interbedded clays (with or without silt), sands, and sandy clays. Below the fill are several interbedded clayey, sandy, and silty layers extending to approximately 10 to 15 feet bgs. This series of units varies in texture both laterally and vertically across the site. Underlying the top 12 to 19 feet of soil is a stiff, gray and brown clay. The base of the clay layer is undefined, but this layer is suspected

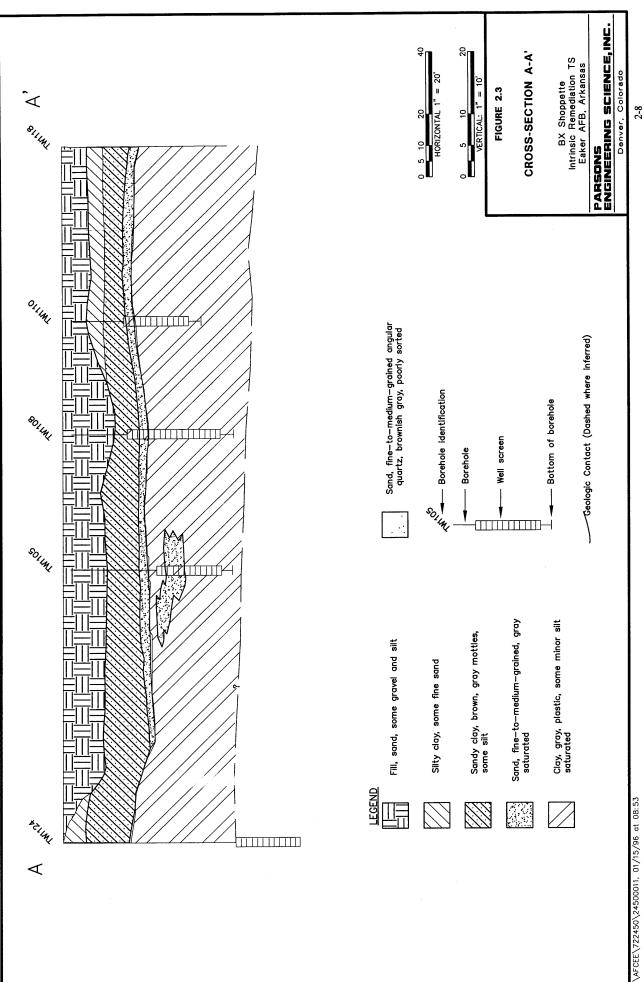
to be a minimum of 10 feet thick. A medium- to coarse-grained sand unit underlies the clay where the sand is present. The sand has not been observed in all deep boreholes and is not believed to be laterally continuous across the site. Figure 2.2 shows the location of stratigraphic cross-sections A-A' and B-B'. Figure 2.3 presents cross-section A-A', which is oriented in a northwest-southeast direction along the axis of groundwater flow. Figure 2.4 presents cross-section B-B', oriented southwest-northeast, approximately perpendicular to the direction of groundwater flow.

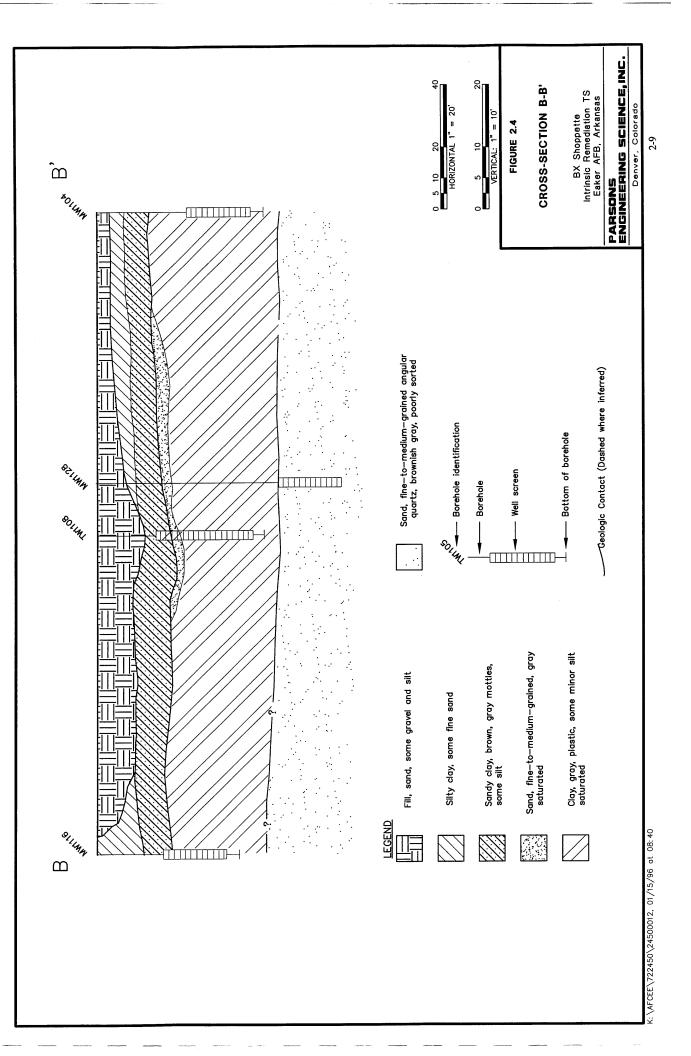
The cross-sections were constructed using geologic boring logs from the Halliburton NUS (1992) site investigation and CPT/laser induced fluorescence (LIF) verification data results collected by the US Army Corps of Engineers (USACE, 1995). The CPT soil data were interpreted using a soil classification graph and a fluorescence graph. The soil graph is constructed by referencing the strain gauge readings, calibration curves, and an empirical relationship. The fluorescence graph presents the relative measurement of the returned fluorescence from the LIF window on the probe. This is a relative measurement of the fuel hydrocarbon contamination. By comparing the CPT soil graph with existing adjacent soil borehole logs, the data were correlated to produce a more complete cross-section and to better define locations of suspected mobile LNAPL. Appendix B presents available geologic boring logs and CPT/LIF output logs

Borehole logs from downgradient monitoring well MW1126 at the eastern corner of the BX Shoppette near Arkansas Avenue (Figure 2.2) show that soils from the surface to 3 feet bgs are a silt and fine-grained sand. From 3 feet bgs to approximately 14 feet bgs is an orange-brown, silty clay, with the silt content decreasing with depth. Below 14 feet bgs, a dark-gray to brown clay with organic fragments and worm burrows extends to 25 feet bgs. The silt content of the clay soil increases with depth, and a fine-grained sandy



2-7





clay is present to a depth of approximately 29 feet bgs. From 29 feet bgs to a total drilled depth of 41 feet bgs a medium-grained, poorly sorted quartz sand is present.

There are currently 21 groundwater monitoring wells at the BX Shoppette. Seven former temporary monitoring wells have been abandoned at the site. All of the wells are screened in the shallow alluvial deposits. These wells were installed during several site investigations as part of the IRP. Groundwater at the site occurs in the sandy units of the Quaternary alluvium and may be perched above the finer-grained clay sediments. Available monitoring well construction details are presented in Table 2.1. Figure 2.5 shows the groundwater surface for the BX Shoppette in March 1992.

Groundwater flow in the immediate vicinity of the site appears to converge on the site from two different directions. West of the BX Shoppette the groundwater flow is to the northeast; however, the confluence of two drainage channels north of the station appears to create a recharge zone, resulting in a southerly groundwater flow from the confluence toward the site. As a result, groundwater flow directly beneath the BX Shoppette is deflected to the east by the convergent flows. The hydraulic gradient across the site ranges from 0.016 foot per foot (ft/ft) south of the fuel tank pit to 0.0017 ft/ft in the immediate tank pit and dispenser area (Halliburton NUS, 1992). The groundwater surface shown on Figure 2.5 correlates with the shape and orientation of the groundwater BTEX plume, implying that the groundwater flow direction at the site is relatively consistent. The converging groundwater flow combined with the small gradient beneath the site, gives groundwater a relatively longer residence time below the site.

In 1988, Halliburton NUS (1992) performed slug tests on shallow aquifer monitoring wells located approximately 2,500 feet northeast of the BX Shoppette. Using the methods of Bouwer and Rice (1976), hydraulic conductivity values at monitoring wells

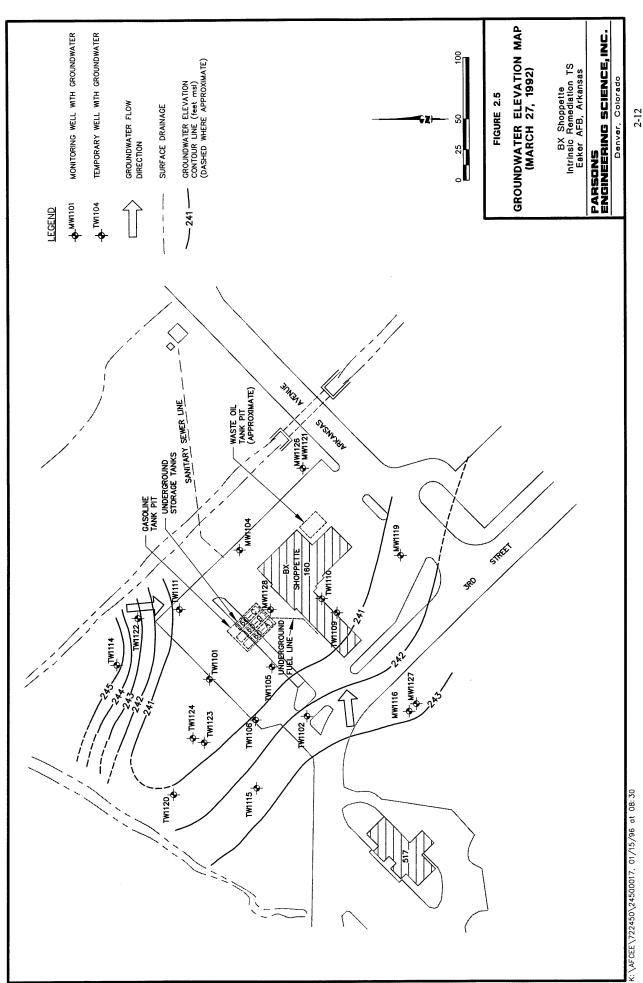
TABLE 2.1 SUMMARY OF WELL COMPLETION DATA BX SHOPPETTE INTRINSIC REMEDIATION TS EAKER AFB, ARKANSAS

		Total	Completion	Screened	Ground	Top of
	Installation	Depth	Depth	Interval	Elevation	Casing
Well ID	Date	(ft bgs)	(ft bgs)	(ft bgs)	(ft msl)	(ft msl)
TW1101	12/11/91	30	27.2	15.2-25.2	NA ^{a/}	NA
TW1101	12/11/91	30	24.7	12.4-22.6	NA NA	249.52
TW1103 ^{b/}	12/11/91	30	27.1	15.1-25.1	NA	249.99
MW1104	12/11/91	30	26.1	14.1-24.1	NA	251.48
TW1105	12/13/91	26	25.2	13.4-23.4	NA	251.14
TW1106	12/13/91	29	25.7	13.5-23.7	NA	250.98
TW1107	12/13/91	30	27.2	15.1-25.2	NA	251.31
TW1108	12/14/91	29	25.2	8.2-23.2	NA	250.75
TW1109	12/14/91	25	20.2	8.2-18.2	NA	250.89
MW1110	12/14/91	25	20.3	8.2-18.2	NA	251.23
MW1111	12/15/91	22	20.1	8.1-18.1	NA	251.32
TW1112	12/15/91	25	25.1	8.1-25.1	NA	250.86
TW1113	12/15/91	27	25.3	8.4-23.3	NA	252.01
MW1114	12/16/91	24	18.4	6.2-16.4	NA	251.64
MW1115	12/16/91	22	18.3	6.2-16.3	NA	250.37
MW1116	12/16/91	22	20	7.9-18.0	NA	250.62
TW1117	12/17/91	12	NA	NA	NA	250.83
TW1118	12/17/91	12	NA	NA	NA	250.42
MW1119	12/17/91	22	17	5.0-15.0	NA	249.75
MW1120	1/7/92	30	29.2	17.2-27.2	NA	251.73
MW1121	4/8/95	17	16.2	4.2-14.2	250.97	253.16
MW1122	4/7/95	18	17.3	5.1-15.1	250.68	253.02
MW1123	8/11/95	20	19	7.0-17.0	251.13	253.56
MW1124	8/12/95	38	38	26.0-36.0	251.93	253.58
MW1125	10/31/95	38	38	26.0-36.0	250.58	253.48
MW1126	11/1/95	41	41	29.0-39.0	250.91	253.70
MW1127	11/3/95	37	36.5	24.5-34.5	250.76	250.56
MW1128	11/5/95	40	40	28.0-38.0	NA	251.34

^a/ NA = Data not availible.

Sources: Halliburton NUS, 1992 and 1995.

^{b/} Temporary wells TW1103, TW1107, TW1108, TW1112, TW1113, TW1117, and TW1118 have been removed.



MW502 and MW504 were calculated to be 2.1 x 10⁻⁴ centimeters per second (cm/sec) and 5.4 x 10⁻⁴ cm/sec, respectively. Using the average of these two measurements, Halliburton NUS (1992) estimated the hydraulic conductivity to be 1.06 feet per day (ft/day) (3.7 x 10⁻⁴ cm/sec) beneath the site. Using a gradient of 0.0017 ft/ft and an estimated porosity of 0.25, the groundwater velocity at the BX Shoppette is approximately 0.007 ft/day. Halliburton NUS (1992) assumed an aquifer thickness of 10 feet and calculated an estimated aquifer transmissivity of 79 gallons per day per foot (gal/day/ft) in the shallow alluvial aquifer below the BX Shoppette.

2.1.3 Summary of Analytical Data for BX Shoppette

2.1.3.1 Soil Sampling and Analytical Results

Historical soil sampling data are available for sampling events that took place in 1991 and 1995. In 1991, 56 soil samples were collected by Halliburton NUS (1994) from boreholes B-1 through B-27, and 12 soil samples were collected from boreholes for wells TW1103, TW1108, TW1109, and TW1110 (Figure 2.6). Four years later, Halliburton NUS (1995) collected 11 additional soil samples during the installation of monitoring wells MW1121 through MW1123 and soil boreholes SB1129 through SB1135. All the soil samples collected during these sampling events were analyzed for BTEX and total petroleum hydrocarbons (TPH). Some soil samples were analyzed for additional contaminants [i.e., metals and semivolatile organic compounds (SVOCs)]; however, results reported for these additional analytes are not of primary importance for completion of this TS and are not summarized in this work plan. Table 2.2 summarizes BTEX and TPH results for all soil samples collected during these sampling efforts. Locations of soil samples collected during the 1991 investigation are shown on Figure 2.6.

TABLE 2.2
SUMMARY OF SOIL ANALYTICAL DATA
BX SHOPPETTE
INTRINSIC REMEDIATION TS
EAKER AFB, ARKANSAS

Borehole ID	Date	Depth (ft bgs)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzne (mg/kg)	Total Xylenes (mg/kg)	Total BTEX (mg/kg)	TPH (mg/kg)
B-1	2/91	5-10 ^{a/}	6.2	47	14	80	147.2	322
~ •		15	2.4	8.2	4.5	17	32.1	176
B-2	2/91	5-10	2.3	24	7.7	40	74	248
		15	3.1	8.6	0.3	2.1	14.1	478
B-3	2/91	5-10	14	250	62	300	626	338
		15	3.6	16	1.8	9.8	31.2	176
B-4	2/91	5-10	ND ^b	22	3.7	14	39.7	484
	2,71	15	ND	ND	ND	ND	ND	477
B-5	2/91	5-10	15	130	22	90	257	559
20	_,,,	15	2.4	15	3.9	16	37.3	351
B-6	2/91	5-10	1.5	18	2.5	14	36	218
		15	1.6	6.2	1	4.6	13.4	147
B-7	2/91	5-10	3.8	44	7.3	44	99.1	212
		15	1.1	0.9	0.2	0.1	2.3	247
B-8	2/91	5-10	5	27	7	39	78	157
		15	ND	ND	ND	ND	ND	163
B-9	2/91	5-10	7.6	43	16	88	154.6	136
2,	,,	15	1.6	1.4	0.2	0.5	3.7	179
B-10	2/91	5-10	11	72	20	110	213	152
2 10		15	ND	ND	ND	ND	ND	203
B-11	2/91	5-10	3.2	15	2.8	14	35	234
		15	1.9	5.2	0.6	2.2	9.9	240
B-12	2/91	5-10	6.3	35	8.2	44	93.5	207
		15	1.6	5.2	0.5	2.4	9.7	210
B-13	6/91	5-10	5.3	24	6.8	33	69.1	<30
		15	0.7	1.1	ND	0.4	2.2	<30
		20	0.8	1.2	0.2	0.8	. 3	<30
B-15	6/91	5-10	5.1	4.2	9.4	73	91.7	46
		15	7.9	30	6.1	27	71	<30
		20	3.7	16	4.5	24	48.2	35
B-16	6/91	5-10	9	37	11	46	103	<30
		15	ND	ND	ND	ND	ND	<30
		20	ND	ND	ND	0.5	0.5	<30
B-17	6/91	5-10	2.3	13	4.3	26	45.6	<30
B-18	6/91	5-10	7.2	20	3.7	22	52.9	<30
		15	6.2	19	5.2	24	54.4	<30
B-19	6/91	5-10	0.5	3	5.4	19	27.9	<30
		15	0.6	1.8	ND	0.7	3.1	<30
		20	0.7	1.9	0.3	0.8	3.7	<30

TABLE 2.2 (Concluded)

SUMMARY OF SOIL ANALYTICAL DATA

BX SHOPPETTE

INTRINSIC REMEDIATION TS EAKER AFB, ARKANSAS

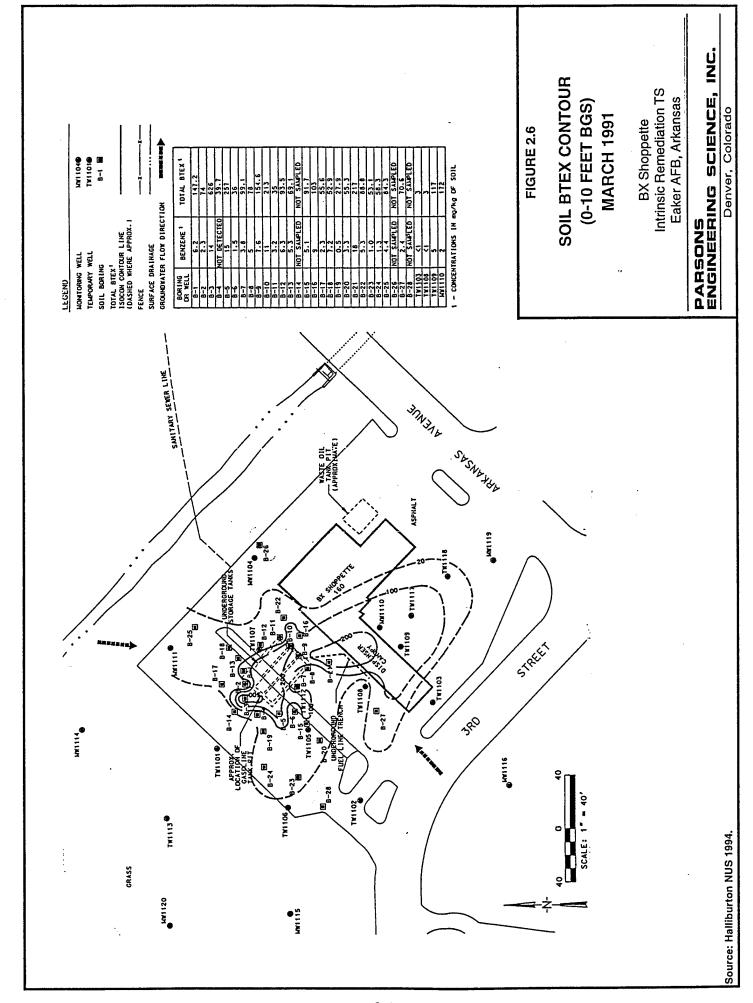
Total Total **Xylenes** BTEX TPH Toluene Ethylbenzne Depth Benzene (mg/kg) (mg/kg) (mg/kg) (mg/kg) (ft bgs) (mg/kg) (mg/kg) Borehole ID Date 26 55.3 <30 26 ND B-20 6/91 5-10 3.3 785 <30 37 280 68 400 15 <30 335 160 14 130 31 20 30 100 217 84 15 6/91 5-10 18 B-21 83 168 64 54 18 13 15 <30 22 4.7 27 62.1 20 8.4 88.8 <30 5-10 5.3 32 7.5 44 6/91 B-22 51 141 <30 65 10 15 15 28 53.1 <30 5-10 1 17 7.1 B-23 6/91 7.8 12.3 <30 15 0.6 2 1.9 29 58.3 <30 1.3 17 11 6/91 5-10 B-24 <30 7.1 11.2 2.3 1.6 15 0.2 <30 20 0.2 0.6 0.2 0.9 1.9 7.9 44 84.3 <30 4.4 28 6/91 5-10 B-25 <30 0.8 1.9 0.1 0.2 0.8 15 70.6 <30 9.2 36 6/91 5-10 2.4 23 B-27 <30 1.1 10 1.6 15 27.7 15 3 3 <20 < 1 < 1 < 1 12/11/95 3 TW1103 <20 < 1 < 1 < 1 < 1 < 1 10 < 1 <20 < 1 < 1 < 1 22 ND 3 <20 < 1 3 5 < 1 < 1 TW1108 12/14/95 5 <20 4 < 1 1 17 < 1 <20 < 1 < 1 < 1 < 1 < 1 21 78 123 172 17 12/14/95 6 5 17 TW1109 < 1 < 1 <20 < 1 < 1 10 < 1 < 1 <20 < 1 < 1 < 1 18 < 1 93 172 23 58 19 12/14/95 6-7 2 TW1110 51 71 <20 19 < 1 1 8.5 <20 3 6 16.5 < 1 3 < 1 ND ND ND ND NA^{c/} ND ND 4/8/95 MW1121A ND ND < 1 < 1 ND MW1122A 4/7/95 NA < 1 ND ND ND NA ND ND ND MW1123A 8/11/95 ND ND ND ND ND NA ND SB1129A 4/6/95 ND ND ND ND ND NA ND 4/6/95 SB1130A ND < 1 ND NA < 1 < 1 ND SB1131A 4/7/95 ND ND ND ND ND ND 4/9/95 NA SB1132A ND ND ND ND ND ND 4/7/95 NA SB1133A ND ND ND ND 4/8/95 NA ND ND SB1134A 38 1.1 5.4 10.1 0.9 2.7 SB1135A 4/7/95 NA 570 NA 6.1 27 15 74 122.1 4/7/95 SB1135B

Sources: Halliburton NUS, 1992 and 1995.

a/ 5-10 foot samples were composited at 5 and 10 feet.

b/ ND = not detected.

c/ NA = data not available.



During the 1991 investigation (Halliburton NUS, 1992), saturated and unsaturated zone soil samples were collected at depths ranging from 5 to 22 feet bgs. Soil BTEX contamination was identified in saturated samples collected below the water table at 20 feet below bgs. However, the saturated samples collected below about 10 feet bgs do not correlate with surface contamination sources and are believed to result from groundwater smear of mobile LNAPL. Appendix B presents figures from Halliburton NUS (1992) that contour the soil contamination below 10 feet bgs.

Significant concentrations of BTEX and TPH in unsaturated soils appear to be limited to soils in the vicinity of the gasoline tank pit and the underground fuel line trench. Figure 2.6 is an isocontour map showing BTEX contamination in soils to a maximum depth of 10 feet bgs. The unsaturated soil BTEX contamination appears to be confined within the site boundaries. The maximum total BTEX contamination measured in unsaturated soils [626 milligrams per kilogram (mg/kg)] was detected in soil borehole B-3, adjacent to the gasoline tank pit. Unsaturated soil contamination in the region of the UST pit is concentrated mostly to the north and west of, and below, the pit. The highest unsaturated total BTEX concentration not related to the tank pit contamination was located at borehole B-21 adjacent to the fuel line trench, that lies between the tank pit and The remainder of the soil sampling indicated lower BTEX the fuel dispensers. concentrations throughout the rest of the BX Shoppette site (Figure 2.6). The fluctuation of the groundwater surface, LNAPL dispersion, and isolated small fuel spills most likely are responsible for the lower outlying soil BTEX concentrations away from the two primary source areas (i.e., the gasoline UST pit and the fuel line).

2.1.3.2 Groundwater Sampling and Analytical Results

A total of 28 monitoring wells have been installed at the BX Shoppette. All of the wells have been installed by Halliburton NUS (1992 and 1995) during several phases of investigation. Seven temporary wells (TW1103, TW1107, TW1108, TW1112, TW1113, TW1117, and TW1118) were removed by Halliburton NUS (1992) after sampling and analysis. Available well construction details are presented in Table 2.1. All of the monitoring wells at the site are screened within the shallow unconsolidated sediments. Groundwater quality data were collected from the BX Shoppette wells in 1992 and 1995 (Halliburton NUS, 1992 and 1995) as part of site assessment activities. BTEX and TPH results for both groundwater sampling events are presented in Table 2.3.

Measurable mobile LNAPL (free product) has been observed in monitoring well TW1105. Immediately after installation, well TW1105 contained 0.3 foot of LNAPL. In January 1992, 5.35 feet of product was measured at monitoring well TW1105, and in February 1992, 10.75 gallons of product was bailed from the well by Eaker AFB personnel (Halliburton NUS, 1992). In May 1992, the LNAPL was measured at approximately 4 feet. Analysis of the LNAPL indicated the product is leaded gasoline. The storage and sale of leaded gasoline at the BX Shoppette ceased in March 1990; therefore, the release that resulted in the accumulation of LNAPL in this area likely occurred before 1990. It is possible that the 1974 leak in the fuel transfer line was the source of the mobile LNAPL in this area (Halliburton NUS, 1992). The lateral extent of the mobile LNAPL plume has not been determined, but the plume is believed to be limited because it has only been observed in monitoring well TW1105. However, the observed BTEX concentration of 36,800 micrograms per liter (μg/L) in a 1995 groundwater sample from monitoring well TW1111, about 100 feet north of TW1105, is

TABLE 2.3
SUMMARY OF GROUNDWATER ANALYTICAL DATA
BX SHOPPETTE
INTRINSIC REMEDIATION TS
EAKER AFB, ARKANSAS

					Total	Total	
	Sample	Benzene	Ethylbenzene	Toluene	Xylene	BTEX	TPH
Well ID	Date	(μg/L)	(μg/L)	(µg/L)	(μg/L)	(μg/L)	(mg/L)
TW1101	6/1/95	610	310	440	880	2240	9
TW1102	6/1/95	$ND^{a\prime}$	ND	ND	ND	ND	ND
MW1104	1/13/92	< 2	< 2	< 2	< 2	< 8	< 0.2
	6/2/95	130	210	170	560	1070	16
TW1105	NS ^{b/}	NS	NS	NS	NS	NS	NS
TW1106	6/2/95	ND	ND	ND	ND	ND	ND
TW1109	6/5/95	2200	170	160	1100	3630	15.5
MW1110	1/13/92	4800	2000	45000 J ^{c/}	7600	59700 J	2
	6/2/95	10000	1000	280	3200	14480	52.5
MW1111	1/13/92	5300 J	1500 J	< 2	7120 J	13920 J	2.7
	6/2/95	5000	2800	14000	15000	36800	21.2
	8/15/95	4100	2000	11000	14000	31100	67
MW1114	1/13/92	< 2	< 2	< 2	< 2	< 8	< 0.2
	6/5/95	ND	ND	ND	ND	ND	ND
MW1115	1/13/92	< 2	< 2	< 2	< 2	< 8	< 0.2
	6/5/95	ND	ND	ND	ND	ND	ND
MW1116	1/12/92	< 2	< 2	< 2	< 2	< 8	< 0.2
	6/5/95	ND	ND	ND	ND	ND	ND
MW1119	1/13/92	< 2	< 2	< 2	< 2	< 8	< 0.2
	6/5/95	ND	ND	ND	ND	ND	ND
MW1120	1/12/92	< 2	< 2	< 2	< 2	< 8	< 0.2
	6/8/95	ND	ND	ND	ND	ND	ND
MW1121	6/8/95	ND	ND	ND	ND	ND	ND
MW1122	6/8/95	ND	ND	ND	ND	ND	ND
MW1123	8/24/95	ND	ND	ND	ND	ND	ND
MW1124	8/25/95	62	5.4	4.5	10	81.9	ND

Sources: Halliburton NUS, 1992 and 1995.

^a/ ND = Not detected.

^{b/}NS = Not sampled because mobile LNAPL was present.

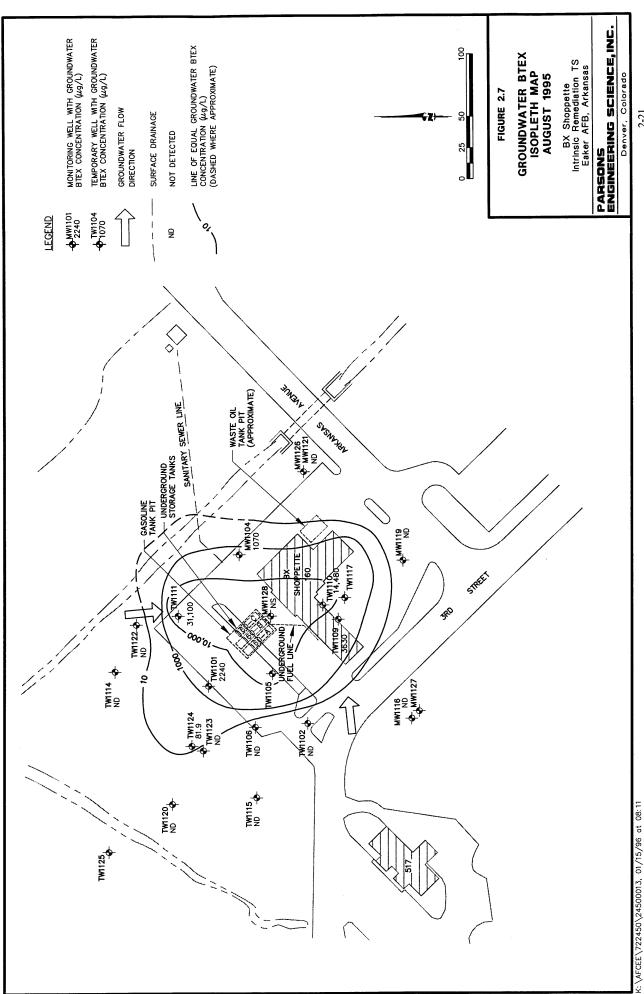
^{c/}J = Estimated value.

near equilibrium BTEX concentrations, and therefore this well may also contain free product.

Elevated concentrations of dissolved BTEX in groundwater correspond with regions of mobile LNAPL and soil contamination (Figure 2.7). Total BTEX concentrations in excess of 10,000 µg/L were detected in 1995 groundwater samples collected from TW1110 and TW1111 (Halliburton NUS, 1995). The dissolved BTEX plume shape is relatively symmetrical; and it does not appear to be traveling away from the site. The convergent groundwater flow from the west and north, coupled with the flat hydraulic gradient appears to be acting to limit plume migration away from the BX Shoppette. The shape of the BTEX plume indicates relatively minor plume expansion to the northwest and southeast. This observed plume expansion may be the result of the BTEX plume traveling within the shallow aquifer in deeper, more conductive layers. At monitoring well cluster MW1123 and MW1124, BTEX compounds were not detected in groundwater samples from the shallower well (MW1123), but 81.9 µg/L total BTEX was detected in a groundwater sample from the deeper well, (MW1124). BTEX was not detected at the shallow downgradient well MW1121; and data from the deeper adjacent well, MW1126, were not available. The downgradient extent of dissolved BTEX in deeper aquifer zones has not been completely defined.

2.1.3.3 Geochemical Indicators of BTEX Degradation

Biodegradation of dissolved fuel hydrocarbons causes measurable changes in groundwater chemistry (Wiedemeier et al., 1995). Microorganisms obtain energy for cell production and maintenance by facilitating thermodynamically advantageous reduction/oxidation reactions involving the transfer of electrons from electron donors to available electron acceptors. This results in the oxidation of the electron donor and the



reduction of the electron acceptor. Electron donors at the BX Shoppette include natural organic carbon and fuel hydrocarbon compounds. Electron acceptors are elements or compounds that occur in relatively oxidized states, and include dissolved oxygen, nitrate, ferric iron, sulfate, and carbon dioxide.

During aerobic respiration of BTEX compounds, oxygen is used as an electron acceptor during microbial mineralization of carbon, and dissolved oxygen concentration decrease. In anaerobic systems where sulfate, nitrate, and ferric iron are available electron acceptors, the concentrations of sulfate and nitrate decrease, and the ferrous iron concentrations increase. In anaerobic conditions where carbon dioxide is used as an electron acceptor, it is reduced by methanogenic bacteria, and methane is produced. Groundwater geochemical data collected at 16 wells at the BX Shoppette by Halliburton NUS (1995) are summarized in Table 2.4. The data indicate that anaerobic biodegradation of BTEX through sulfate reduction may be occurring at the site. Aerobic biodegradation may be occurring, but data indicating this are not available.

Groundwater alkalinity is a measure of the ability of groundwater to buffer changes in pH caused by the generation of biologically generated acids. Increased alkalinity in the areas of groundwater BTEX contamination can occur in response to increased carbon dioxide concentrations, which are a product of BTEX biodegradation (Morell and Hering, 1993). Figure 2.8 presents an isopleth map of groundwater alkalinity in August 1995.

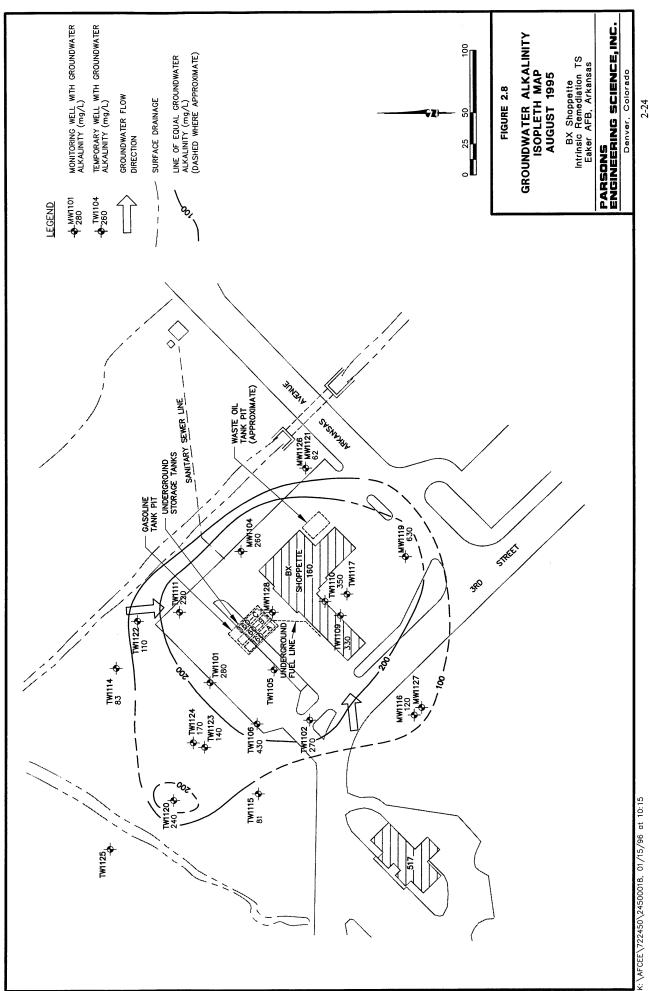
Sulfate also appears depleted in the areas corresponding to the BTEX plume (Figure 2.7) at the site, which suggests anaerobic BTEX biodegradation through sulfate reduction. Figure 2.9 is an isopleth map of August 1995 groundwater sulfate concentrations. In this anaerobic process, the BTEX compounds combine with sulfate and hydrogen to produce carbon dioxide, water, and sulfur. Comparison of Figures 2.8 and 2.9 with the

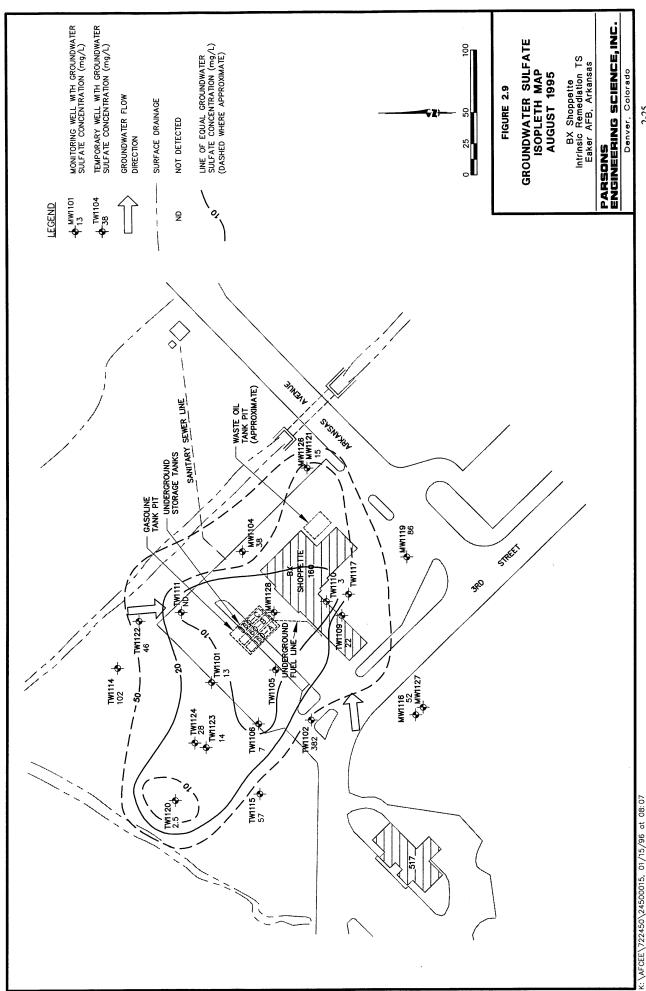
TABLE 2.4 SUMMARY OF GROUNDWATER GEOCHEMICAL DATA BX SHOPPETTE INTRINSIC REMEDIATION TS EAKER AFB, ARKANSAS

	Nitrate	Alkalinity	Sulfate	Chloride	
Well ID	(mg/L)	(mg/L)	(mg/L)	(mg/L)	
TW1101	ND ^{a/}	280	13	5	
TW1102	ND	270	382	5	
MW1104	ND	260	38	7	
TW1106	0.013	430	7	4	
TW1109	0.1	330	22	36	
MW1110	0.12	350	3	200	
MW1111	0.03	220	ND	ND	
MW1114	ND	83	102	24	
MW1115	0.16	81	57	9	
MW1116	0.02	120	52	3	
MW1119	0.01	630	86	9	
MW1120	ND	240	2.5	ND	
MW1121	0.13	62	15	ND	
MW1122	ND	110	46	ND	
MW1123	ND	140	14	ND	
MW1124	ND	170	28	1	

a/ ND = Not detected.

Source: Halliburton NUS, 1995.





groundwater BTEX plume (Figure 2.7) shows graphically that the areas of relatively high alkalinity and reduced sulfate correspond with the BTEX plume. This is a preliminary indication that biodegradation of BTEX compounds is occurring at the site. Additional analysis of these and other attenuation processes will be provided in the TS report.

2.2 DEVELOPMENT OF CONCEPTUAL SITE MODEL

A CSM is a three-dimensional representation of a site's hydrogeologic system based on available geological, hydrological, climatological, and geochemical data. A CSM is developed to provide an understanding of the mechanisms controlling contaminant fate and transport and to identify additional data requirements. The model describes known and suspected sources of contamination, types of contamination, affected media, and contaminant migration pathways. The model also provides a foundation for formulating decisions regarding additional data collection activities and potential remedial actions. The CSM for the BX Shoppette will be used to aid in selecting additional data collection points and to identify appropriate data needs for quantifying and simulating groundwater flow characteristics and evidence of hydrocarbon degradation using groundwater flow and solute transport models.

Successful conceptual model development involves:

- Defining the problem to be solved;
- Integrating available data, including
 - Local geologic and topographic data,
 - Hydraulic data,
 - Site stratigraphic data, and

- Contaminant concentration and distribution data;
- Evaluating contaminant fate and transport characteristics;
- Identifying contaminant migration pathways;
- Identifying potential receptors and receptor exposure points; and
- Determining additional data requirements.

2.2.1 Predicting Intrinsic Remediation with Fate and Transport Models

The positive effect of natural attenuation processes (e.g., advection, dispersion, sorption, and biodegradation) on reducing the actual mass of fuel-related contamination dissolved in groundwater has been termed intrinsic remediation. Advantages of intrinsic remediation include: (1) contaminants are transformed to innocuous byproducts (e.g., carbon dioxide and water), not just transferred to another phase or location within the environment; (2) current pump-and-treat technologies are energy-intensive and generally not as effective in reducing residual contamination; (3) the process is nonintrusive and allows continuing use of infrastructure during remediation; (4) current engineered remedial technologies may pose a greater risk to potential receptors than intrinsic remediation because contaminants may be transferred into the atmosphere during remediation activities; and (5) intrinsic remediation is far less costly than conventional, engineered remedial technologies.

An accurate estimate of the potential for natural biodegradation of BTEX compounds in groundwater is important to consider when determining whether fuel hydrocarbon contamination presents a substantial threat to human health and the environment (through modeling), and when deciding what type of remedial alternative will be most cost effective in eliminating or abating such threats. Over the past two decades, numerous

laboratory and field studies have demonstrated that subsurface microorganisms can degrade a variety of hydrocarbons (Lee, 1988). This process occurs naturally when sufficient oxygen (or other electron acceptors) and nutrients are available in the groundwater. Hence, biodegradation is considered the most important natural attenuation process operating to remove BTEX contamination. The rate of natural biodegradation is generally limited by the lack of oxygen (or other electron acceptors) rather than by the lack of nutrients such as nitrogen or phosphorus. The supply of oxygen to unsaturated soil is constantly renewed by the vertical diffusion from the atmosphere. The supply of oxygen to a shallow, fuel-contaminated aquifer is constantly renewed by the influx of oxygenated, upgradient flow and precipitation recharge, and by the vertical diffusion of oxygen from the unsaturated soil zone into the groundwater (Borden and Bedient, 1986). The rate of natural biodegradation in unsaturated soil and shallow aquifers is largely dependent upon the rates at which oxygen and other electron acceptors enter the contaminated media.

By combining site-specific geochemical and chemical evidence, the potential for intrinsic remediation can be quantified through fate and transport modeling. Several analytical and numerical models are available for modeling the fate and transport of fuel hydrocarbons under the influence of advection, dispersion, sorption, and natural aerobic and anaerobic biodegradation. Analytical models may be used in conjunction with numerical models, such as Bioplume II, as appropriate. The Bioplume II numerical model is based upon the US Geological Survey (USGS) two-dimensional (2-D) solute transport model (Konikow and Bredehoeft, 1978), which has been modified to include a biodegradation component that is activated by a superimposed plume of dissolved oxygen. Bioplume II solves the USGS 2-D solute equation twice, once for hydrocarbon concentrations in the groundwater and once for a dissolved oxygen plume. The two

plumes are then combined using superimposition at every particle move to simulate biological reactions between fuel products and oxygen. As appropriate, biodegradation of contaminants by anaerobic processes is simulated using a first-order decay rate. The Bioplume II model will be used to predict the fate and transport of contaminants at the BX Shoppette site.

2.2.2 Initial Conceptual Site Model

The BX Shoppette hydrogeologic data were previously integrated to produce two hydrogeologic cross-sections of the site. Cross sections A - A' and B - B' (Figures 2.3 and 2.4) show the interbedded hydrostratigraphic units present at the site as determined from previous cross-sections and USACE (1995) CPT results. Figure 2.5 is a groundwater surface map prepared using March 1992 groundwater elevation data (Halliburton NUS, 1992)

The water table is present at approximately 7 to 12 feet bgs, in the silty sand and sandy clay deposits in the beneath the site. Groundwater flow converges in the site vicinity from the west and north, with gradients ranging from 0.016 ft/ft to 0.0017 ft/ft. On the basis of the available data, Parsons ES will model the site as an unconfined, fine-grained sand aquifer interbedded with clay sediments. The aquifer may become confined with depth due to overlying clay units, and the CSM will be modified as necessary as additional site hydrogeologic data become available. Vertical migration of site contaminants in groundwater will be further investigated in the source area near monitoring well TW1105 to evaluate the spread of dissolved BTEX in different aquifer subunits.

Mobile LNAPL is believed to be present at the BX Shoppette, and it may be necessary to use the fuel/water partitioning models of Bruce et al. (1991) or Cline et al. (1991) to provide a conservative source term to model the partitioning of BTEX from the mobile LNAPL into the groundwater. In order to use one of these models, samples of free product will be collected and analyzed for mass fraction of BTEX. Parsons ES also will collect additional groundwater samples from immediately below the LNAPL layer. Mobile LNAPL has been observed in well TW1105; the lateral extent of free product has not been determined. Figure 2.7 shows the extent of BTEX groundwater contamination at the site. Information from this map and historical soil contamination data for the site (Figure 2.6) will be used to select the locations of new monitoring wells to fully define the extents of the mobile LNAPL and dissolved BTEX plumes at the BX Shoppette.

Because of it solubility and relative toxicity, benzene is the primary chemical of interest in groundwater at the BX Shoppette. However, the synergistic effects of all of the BTEX compounds on attenuation rates make site data on all of the BTEX compounds important. Therefore, the BTEX compounds will be the primary focus of this intrinsic remediation TS. The Bioplume II model will be used to simulate the degradation of these chemicals at the BX Shoppette and to predict the concentrations and extent of the contaminant plumes in the groundwater over time.

Dissolved BTEX compounds at the site are expected to continue to leach from contaminated soils containing fuel residuals, to dissolve from mobile LNAPL into the groundwater, and to migrate downgradient as a dissolved contaminant plume. In addition to the effects of mass transport mechanisms (volatilization, dispersion, diffusion, and adsorption), these dissolved contaminants will likely be removed from the groundwater system by destructive attenuation mechanisms, such as biodegradation. The effects of

these fate and transport processes on the dissolved BTEX plume will be investigated using the quantitative groundwater analytical data and the solute transport models. Data collection and analysis requirements are discussed in Section 3 of this work plan.

2.2.3 Potential Pathways and Receptors

Potential preferential contaminant migration pathways such as groundwater discharge points and subsurface utility corridors (artificial conduits) will be identified during the field work phase of this project. The primary potential migration path for contaminants at the BX Shoppette is from the residual LNAPL in contaminated soils and mobile LNAPL at the site into the groundwater, and from the groundwater to potential downgradient receptors via ingestion or incidental contact.

Shallow groundwater beneath the site flows toward the east. There are no known operating potable or nonpotable water wells (other than monitoring wells) located within 1 mile downgradient or crossgradient from the site. Surface drainage by overland flow from the site discharges into the adjacent surface drainages and flows into Ditch 25, north of the site. Shallow soil contamination at the site is located at the gasoline tank pit and fuel trench, and is not expected to impact surface water quality due to the asphalt cover.

The potential for exposure to contaminated groundwater originating from the site through ingestion is low because Base access is restricted and Base drinking water does not come from wells located downgradient from the site and within the surfical aquifer. Pavement at the site prevents surface water/soil contact. However, fuel vapors could migrate into the BX Shoppette building. There are four deep-aquifer potable- water wells located approximately 2.3 miles southeast of the Base that are used by the city of Blytheville. Site contaminants are not expected to migrate to any of these drinking water

wells. However, determining the potential impacts from shallow groundwater discharge into the adjacent drainage ditch will be of primary importance for assessing the feasibility of intrinsic remediation at the BX Shoppette and will be considered in greater detail once additional site data essential for the evaluation of intrinsic remediation have been collected.

SECTION 3

COLLECTION OF ADDITIONAL DATA

To complete the TS and to evaluate whether natural attenuation of fuel-related contaminants is occurring, additional site-specific hydrogeologic data will be collected. The physical and chemical hydrogeologic parameters listed below will be determined during the field work phase of the TS.

Physical hydrogeologic characteristics include:

- Depth from measurement datum to the groundwater surface in existing monitoring wells;
- Locations of potential groundwater recharge and discharge areas;
- Locations of downgradient wells and their uses;
- Hydraulic conductivity through slug tests, as required;
- Estimation of dispersivity, where possible;
- Stratigraphic analysis of subsurface media;
- Groundwater temperature; and
- Determination of extent and thickness of mobile- and residual-LNAPL.

Chemical hydrogeologic characteristics include:

• Dissolved oxygen (DO) concentrations;

- Specific conductance;
- pH;
- Chemical analysis of mobile LNAPL to determine mass fraction of BTEX; and
- Additional chemical analysis of groundwater and soil for the parameters listed in Table 3.1.

Field work described in this work plan in support of the TS will be completed in March 1996. The objective of field work will be to define the extent of residual and mobile LNAPL hydrocarbon contamination using CPT in conjunction with LIF testing and soil, groundwater, and mobile LNAPL sampling. Areas of residual and free-phase hydrocarbon contamination were sampled during field operations conducted in 1991, 1992, and 1995; however, additional LIF testing will be required during the upcoming field operations to better define the extent of residual and mobile LNAPL.

The following sections describe the procedures that will be followed when performing field investigations and collecting site-specific data. The CPT/LIF system is described in Section 3.1. Procedures for soil sample collection to verify CPT/LIF data are described in Section 3.1.2. Procedures for the installation of new monitoring points are described in Section 3.2. Procedures for sampling existing groundwater monitoring wells and newly installed groundwater monitoring points are described in Section 3.3, and procedures for the measurement of aquifer parameters (e.g., hydraulic conductivity) are described in Section 3.4.

TABLE 3.1

ANALYTICAL PROTOCOL FOR GROUND WATER AND SOIL SAMPLES

BX SHOPPETTE

INTRINSIC REMEDIATION TS EAKER AFB, ARKANSAS

MATRIX Analyte	METHOD	FIELD (F) OR ANALYTICAL LABORATORY (L)
WATER		
Total Iron	Colorimetric, Hach Method 8008 (or similar)	F
Ferrous Iron (Fe+2)	Colorimetric, Hach Method 8146 (or similar)	F
Ferric Iron (Fe+3)	Difference between total and ferrous iron	F
Manganese	Colorimetric, Hach Method 8034 (or similar)	F
Sulfide	Colorimetric, Hach Method 8131 (or similar)	F
Sulfate	Colorimetric, Hach Method 8051 (or similar)	F
Nitrate	Titrimetric, Hach Method 8039 (or similar)	F
Nitrite	Titrimetric, Hach Method 8507 (or similar)	F
Redox Potential	A2580B, direct-reading meter	F
Oxygen	Direct-reading meter	F
pH	E150.1/SW9040, direct-reading meter	F
Conductivity	E120.1/SW9050, direct-reading meter	F
Temperature	E170.1	F
Alkalinity (Carbonate [CO3-2] and Bicarbonate [HCO3-1])	Titrimetric, Hach Method 8221 (or similar)	F
Carbon Dioxide	CHEMetrics Method 4500	F
Nitrate	E300 or SW9056	L
Nitrite	E300 or SW9056	L
Chloride	E300 or SW9056	L
Sulfate	E300 or SW9056	L
Alkalinity	E150.1	L
Methane	RSKSOP 175 ^a /	L
Total Organic Carbon	A5310C	L
Aromatic Hydrocarbons (Including Trimethylbenzene and Tetramethylbenzene)	SW8020	L
Total Hydrocarbons	SW8015, modified for gasoline-range organics	L
FREE PRODUCT		
Free Product	GS/MS, Direct Injection	L
SOIL		
Total Organic Carbon	SW9060	L
Moisture	ASTM D-2216	L
Aromatic Hydrocarbons	SW8020	L
Total Hydrocarbons	SW8015, modified for gasoline-range organics	L

^{a/}RSKSOP = Robert S. Kerr Laboratory standard operating procedure.

3.1 CONE PENETROMETRY

Subsurface conditions at the site will be characterized using CPT coupled with LIF. Cone penetrometry is an expeditious and effective means of analyzing the stratigraphy of a site by measuring resistance against the conical probe of the penetrometer as it is pushed into the subsurface. Stratigraphy is determined from a correlation of the point stress at the probe tip and frictional stress on the side of the cone. Soil cores also are collected to correlate the CPT readings to the lithologies present at the site.

CPT will be conducted using the USACE's cone penetrometer truck. This equipment consists of an instrument probe that is forced into the ground using a hydraulic load frame mounted on a heavy truck, with the weight of the truck providing the necessary reaction mass. The penetrometer equipment is housed in a stainless steel, dual-compartment body mounted on a 43,000-pound, triple-axle Kenworth[®] truck chassis powered by a turbocharged diesel engine. The weight of the truck and equipment is used as ballast to achieve the overall push capability of 39,000 pounds. This push capacity may be limited in tight soils by the structural bending capacity of the 1.40-inch outside-diameter (OD) push rods, rather than by the weight of the truck. The current 39,000-pound limitation is intended to minimize the possibility of push-rod buckling. Penetration force is supplied by a pair of large hydraulic cylinders bolted to the truck frame.

The penetrometer probe is of standard dimensions, having a 1.40-inch OD, a 60-degree conical point with sacrificial tip, and an 8.0-inch-long by 1.40-inch OD friction sleeve. Inside the probe, two load cells independently measure the vertical resistance against the conical tip and the side friction along the sleeve. Each load cell is a cylinder of uniform cross-section that is instrumented with four strain gauges in a full-bridge circuit. Forces are sensed by the load cells, and the data are transmitted from the probe

assembly via a cable running through the push tubes. The analog data are digitized, recorded, and plotted by computer in the penetrometry truck. A grout tube also runs down the push cylinder to allow the emplacement of cement grout in order to seal the CPT hole. The USACE CPT is not equipped to monitor pore pressure; therefore, the location of the water table will not be measured using the CPT apparatus. However, evaluation of point and sleeve stresses can often provide an estimated depth to groundwater. The penetrometer is usually advanced vertically into the soil at a constant rate of 2 cm/s, although this rate must sometimes be reduced, such as when hard layers are encountered. Penetration, dissipation, and resistivity data will be used to determine lithologic layering as it is encountered in the field.

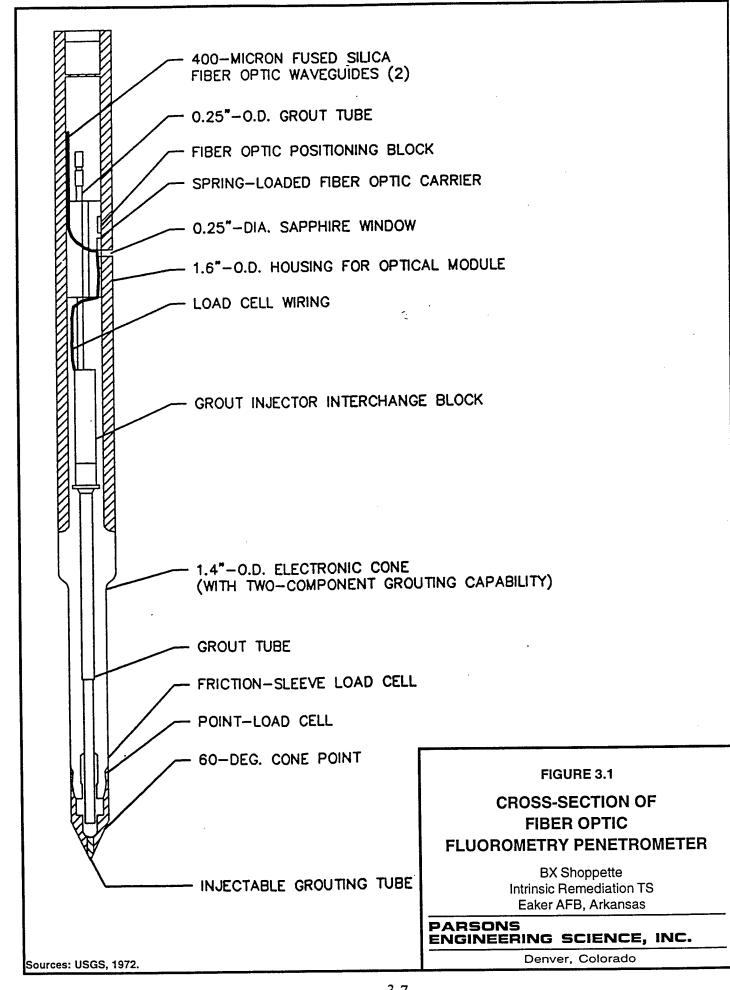
The known propensity of aromatic hydrocarbons to fluoresce under ultraviolet wavelengths has allowed the use of LIF technology, in conjunction with CPT technology, to detect soil characteristics and hydrocarbon contamination simultaneously. The LIF is not capable of detecting chlorinated solvents. The LIF is only useful for more grossly contaminated areas with mobile LNAPL or significant residual contamination The lower range of detection is greater than 100 mg/kg total concentrations. hydrocarbons. The LIF system has a 0.25-inch sapphire window in the side of the cone that allows a laser to scan the soil for fluorescent compounds as the LIF penetrometer rod Assuming that aromatic hydrocarbons are simultaneously pushes through soil. solvenated with other fuel-hydrocarbon constituents, the magnitude of aromatic fluorescence is indicative of hydrocarbon contamination in a soil matrix. Fiber optic cables connected to the laser spectrometer and a 6-pair electrical conductor connected to the CPT data acquisition system, are routed through the interior of the push tubes to the CPT probe.

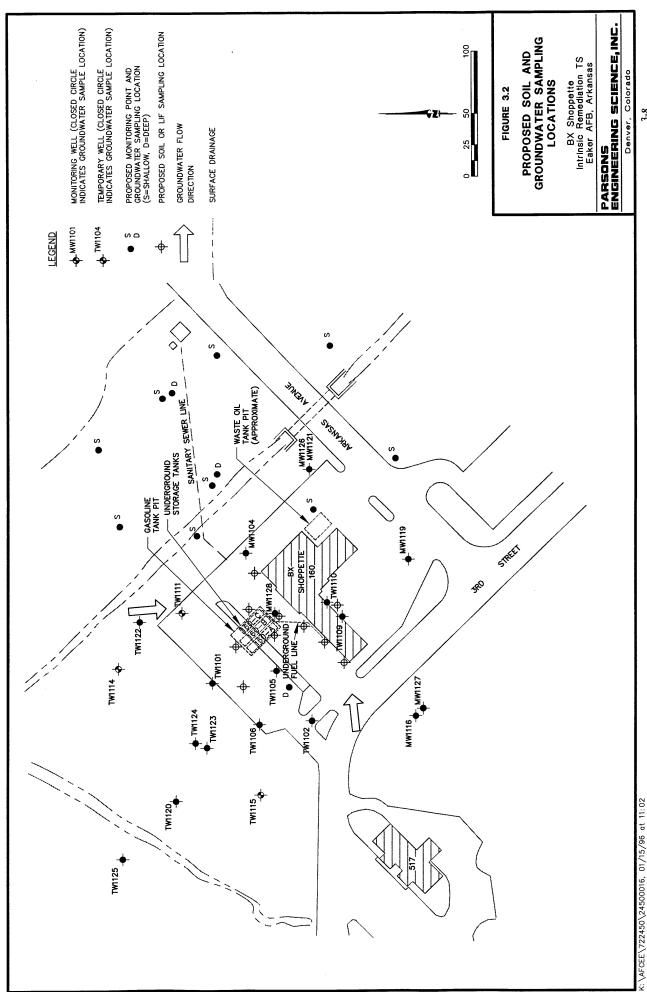
The basic components of the LIF instrument are a nitrogen laser, a fiber optic probe, a monochromator for wavelength resolution of the return fluorescence, a photomultiplier tube to convert photons into an electrical signal, a digital oscilloscope for waveform capture, and a control computer. The fiber optic probe for the cone penetrometer consists of delivery and collection optical fibers, a protective sheath, a fiber optic mount within the cone, and a 0.25-inch sapphire window (Figure 3.1).

The results of each CPT/LIF push will be available 2 or 3 minutes after the completion of each hole. Graphs showing cone resistance, sleeve friction, soil classification, fluorescence intensity, and wavelength will be plotted by USACE personnel at the conclusion of each penetration and presented to the Parsons ES field scientist in order to allow investigative decisions to be based on the most current information.

3.1.1 CPT/LIF Testing Strategy

The purpose of the CPT/LIF testing at the site is to determine subsurface stratigraphy and to better define the areal and vertical extent of residual fuel hydrocarbons in the unsaturated zone and free-phase hydrocarbons in the site groundwater. The CPT will be pushed from ground surface to below fluorescing contamination, refusal, or up to 60 feet bgs, depending on contaminant distribution and subsurface conditions. In order to define the edges of mobile LNAPL contamination, CPT/LIF points be will placed at the locations shown on Figure 3.2. The majority of the points will be used to better define the vertical and lateral extent of the mobile LNAPL layer that has been observed in monitoring well TW1105. Points will be placed at the estimated outer extent of the LNAPL to establish a known mobile LNAPL plume location. CPT/LIF points also will be placed closer or further away, as necessary, to define the extent of the layer. Other CPT/LIF sites are located downgradient from the site across the drainage ditch and will





be used to install monitoring points to collect groundwater BTEX and electron acceptor data. One CPT point will be located north of the site to serve as a background monitoring point. The proposed CPT locations will be repositioned, as needed, based on data collected at the time of field sampling.

Base personnel will coordinate with the USACE to identify the location of all utility lines, USTs, fuel lines, and any other underground infrastructure prior to any CPT activities. All necessary digging permits will be obtained by Base and the USACE personnel prior to mobilizing to the field. Digging permits issued in 1995 for previous USACE (1995) work at the BX Shoppette may be used if Base authorities agree. Base personnel also will coordinate with USACE to acquire drilling and monitoring point installation permits for the proposed CPT/LIF locations indicated in Figure 3.2.

3.1.2 Soil Sampling and Analysis

To check the CPT soil classifications and to calibrate the LIF data, soil samples from discrete intervals will be collected at the site. Soil samples will be collected from varied soil units (if present) within source areas and visibly contaminated areas, at the fringe of the identified residual or mobile LNAPL hydrocarbon plume, and outside of the LNAPL plume. Soil samples will be collected at up to 13 locations. Figure 3.2 shows the locations for 10 proposed sampling locations. In addition, a minimum of three samples will be collected from background or uncontaminated downgradient locations for total organic carbon (TOC) analysis. These sampling locations will be determined by the field scientist based on field data collected using the CPT.

When soil samples are collected using the CPT, a Hoggen-Toggler® attachment for the CPT push rods will be used. A Hoggen-Toggler® sampler is a device used to collect undisturbed soil samples at any desired depth within the range of the driving apparatus.

The sampler is coupled to the penetrometer rod and pushed into the soil with the CPT truck. With the Hoggen-Toggler[®] cone in the closed position, soil is prevented from entering the sampling tube until the desired depth is achieved. When the sampler has been pushed to the depth at which the soil sample is to be taken, the sampling unit is raised a few inches and the Hoggen-Toggler[®] apparatus is opened. The open Hoggen-Toggler[®] is then pushed to fill with soil, then pulled from the ground as quickly as possible. The Hoggen-Toggler[®] sampling apparatus allows collection of 8-inch-long by 1-inch inside-diameter (ID) continuous samples. Recovery efficiencies for samples in saturated or sandy soils are often reduced, or the samples are compromised, because of spillage of the soil from the device after extraction. To mitigate this problem, soil samples will be compressed *in situ* with the penetrometer and Hoggen-Toggler [®] assembly to expel the pore water before extraction.

When the Hoggen-Toggler[®] sampling technique described above is ineffective or unable to efficiently provide sufficient soil volumes for the characterization of the site, soil samples will be obtained using a hand auger or similar method judged acceptable by the Parsons ES field scientist. Procedures will be modified, if necessary, to ensure good sample recovery.

Recovered soil will be placed in analyte-appropriate sample containers (Appendix A) and shipped to an approved analytical laboratory for analysis of BTEX, TOC, moisture content, and TPH by the analytical methods listed in Table 3.1. The lithology of recovered soil will be recorded for comparison and correlation with CPT results.

The Parsons ES field scientist will be responsible for observing all field investigation activities, maintaining a detailed descriptive log of all subsurface materials recovered during soil coring, photographing representative samples, and properly labeling and

storing samples. An example of the proposed geologic boring log form is presented in Figure 3.3. The descriptive log will contain the following information:

- Sample interval (top and bottom depth);
- Sample recovery;
- Presence or absence of contamination based on visual observations, odor, and photoionization detector (PID) headspace measurements;
- Lithologic description, including relative density, color, major textural
 constituents, minor constituents, porosity, relative moisture content, plasticity of
 fines, cohesiveness, grain size, structure or stratification, relative permeability, and
 any other significant observations; and
- Depths of lithologic contacts and/or significant textural changes measured and recorded to the nearest 0.1 foot.

3.1.3 CPT Locations and Datum Survey

The horizontal location of all CPT/LIF testing locations relative to established Base coordinates will be measured by a licensed surveyor. Horizontal coordinates will be measured to the nearest 0.1 foot. The elevation of the ground surface will also be measured to the nearest 0.1 foot relative to a USGS msl datum. Sample location and other relevant site information for the soil cores collected for verification purposes will be recorded by the Parsons ES field scientist.

GEOLOGIC BORING LOG Sheet 1 of 1 _____ DATE SPUD: _____CONTRACTOR: _ BORING NO .: ____ AFCEE _____ DATE CMPL.: ____RIG TYPE: CLIENT: 722450.15 DRLG METHOD: CPT ELEVATION: JOB NO.: LOCATION: <u>EAKER AFB</u> BORING DIA.: _____ TEMP: GEOLOGIST: ______DRLG FLUID: NONE WEATHER: COMMENTS: _____

Elev	Depth	1 Pr	-o-	US			ample	Sample	Penet		WKSPC	TOTAL	TPH]
(ft)	(ft)	fi	ile	CS	Geologic Description		Depth (ft)	Туре	Res	PID(ppm)	PID(ppm)	BTEX(ppm)	(ppm)	
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NOTES

bgs — Below Ground Surface $\, {\sf D} - {\sf DRIVE} \,$

GS - Ground Surface

TOC — Top of Casing

NS — Not Sampled

SAA - Same As Above

SAMPLE TYPE

C - CORE

G - GRAB

▼ Water level drilled

FIGURE 3.3

GEOLOGIC BORING LOG

BX Shoppette Intrinsic Remediation TS Eaker AFB, Arkansas

PARSONS

ENGINEERING SCIENCE, INC.

Denver, Colorado

3.1.4 Site Restoration

After sampling is complete, each CPT location will be restored as closely to its original condition as possible. Any test holes remaining open after extraction of the penetrometer rod will be sealed with hydrated bentonite chips, pellets, or grout to eliminate the creation or enhancement of contaminant migration pathways to the groundwater. Soil sampling using the CPT creates minor volumes of soil waste. The accumulated volume of soil waste generated during field activities will be collected in 55-gallon drums or buckets and disposed of at the soil landfarm located on Base.

3.1.5 Equipment Decontamination Procedures

The CPT push rods will be cleaned with potable water using the USACE CPT steam-cleaning system (rod cleaner) as the rods are withdrawn from the ground. A vacuum system located beneath the CPT truck will be used to recover rinseate. Use of this system results in nearly 100-percent recovery of steam-cleaning rinseate from the rod cleaner. Rinseate is generated only as the rods move past the cleaner, thereby minimizing liquid waste generation. Care will be taken not to apply the pressurized steam to the LIF module, which will be decontaminated by hand. Rinseate will be collected in 55-gallon drums. USACE personnel will arrange for final disposal of the containerized rinseate. USACE personnel are responsible for sampling the contents of the drums to identify any hazardous constituents before the drums are transported to an appropriate disposal facility. Other downhole and sampling equipment will be decontaminated by steam cleaning or by the procedures specified in Section 3.3.2.1.

Potable water to be used in CPT equipment cleaning, decontamination, or grouting will be obtained from one of the Base water supplies. Water use approval will be verified by contacting the appropriate facility personnel. The field scientist will make the final 3-13

determination as to the suitability of site water for these activities. Precautions will be taken to minimize any impact on the surrounding area that might result from decontamination operations.

3.2 PERMANENT MONITORING POINT INSTALLATION

To further characterize the hydrogeologic conditions of the shallow subsurface, up to 12 groundwater monitoring points may be installed at the site to supplement the existing site monitoring wells. The following sections describe the proposed monitoring point locations and completion intervals, monitoring point installation, monitoring point development, and equipment decontamination procedures.

3.2.1 Monitoring Point Locations and Completion Intervals

The locations of 12 proposed groundwater monitoring points are identified for the BX Shoppette site on Figure 3.2. The proposed locations for the new monitoring points were determined from a review of data gathered during previous site activities. Monitoring point locations were selected to provide hydrogeologic data necessary for successful implementation of the Bioplume II model and to monitor potential fuel hydrocarbon migration from the site. Monitoring point locations were selected to define three aspects of the site: 1) the areal extent of residual and mobile LNAPL contamination, 2) the horizontal and vertical distribution of dissolved BTEX, and 3) the hydrogeology and groundwater flow direction at the site. The proposed locations shown on Figure 3.2 may be modified in the field as a result of encountered field conditions and acquired field data.

Several shallow monitoring points are proposed to define the areal extent of contamination. Eight shallow monitoring points are proposed to be located east of the site to define the lateral extent of the dissolved contaminant migration. At least two deep

monitoring points will be located along the downgradient contaminant flow path to define the vertical extent of BTEX compounds. Another deep point will be placed adjacent to TW1105 to determine if any vertical migration of BTEX is occurring within the mobile LNAPL source area. The final proposed point will be located downgradient of the site near the intersection of the Arkansas and Third Street. Data from this monitoring point will provide additional information on electron acceptor concentrations and define the extent of the BTEX plume.

Screened intervals for shallow monitoring points will extend from approximately 1 foot above the water table to 2 feet below the water table. Deep points will be placed on the basis of lithology, or approximately 10 feet below the next shallowest monitoring point (in the absence of significant lithologic changes). All monitoring points will be installed with 1 meter of screen. The proposed screened intervals of 1 meter will help mitigate the dilution of water samples from potential vertical mixing of contaminated and uncontaminated groundwater in the monitoring point casing, and will give important information on the nature of vertical hydraulic gradients in the area. Adjustments of the depth and length of the screened interval of the monitoring points may be necessary in response to actual aquifer conditions and contaminant stratification identified during LIF/CPT testing.

3.2.2 Monitoring Point Installation Procedures

This section describes the procedures to be used for installation of new groundwater monitoring points. All new monitoring points will be constructed of 0.75-inch OD/0.5-inch ID polyvinyl chloride (PVC) casing placed with a CPT pushrod using equipment described in Section 3.1.

3.2.2.1 Pre-Placement Activities

All necessary digging, drilling, and groundwater monitoring point installation permits will be obtained prior to mobilizing to the field. In addition, all utility lines will be located, and proposed drilling locations will be cleared prior to any intrusive activities. Responsibilities for these permits and clearances are discussed in Section 3.1.1.

Water to be used in monitoring point installation and equipment cleaning will be obtained from one of the Base water supplies. Water use approval will be verified by contacting the appropriate facility personnel. The field scientist will make the final determination as to the suitability of water for these activities.

3.2.2.2 Groundwater Monitoring Point Installation

3.2.2.2.1 Monitoring Point Materials Decontamination

Monitoring point completion materials will be inspected by the field scientist and determined to be clean and acceptable prior to use. If not factory sealed, casing, screen, and casing plugs and caps will be cleaned prior to use with a high-pressure, steam/hot-water cleaner using approved water. Materials that cannot be cleaned to the satisfaction of the field scientist will not be used.

3.2.2.2.2 Monitoring Point Screen and Casing

Groundwater monitoring points will be installed by attaching 0.75-inch OD/0.5-inch ID PVC casing and screen to a sacrificial tip and threading the casing/screen through the penetrometer pushrod. As the pushrod is pressed into the ground, new 0.75-inch OD/0.5-inch ID PVC casing will be continuously attached until the desired depth is reached and a fully cased monitoring point is created. Data collection devices such as CPT and LIF will not be used during monitoring point placement; however, a CPT test will be performed at

each monitoring point location prior to monitoring point placement in order to select desired screen depths.

Monitoring point casing and screens will be constructed of flush-threaded, Schedule 40 PVC. The screens will be factory slotted with 0.01-inch openings. Casing joints will not be glued. The PVC top cap for monitoring points completed at or below grade will not be vented in order to minimize the potential for surface water entering the point.

The field scientist will verify and record the total depth of the monitoring point, the lengths of all casing sections, and the depth to the top of all monitoring point completion materials. All lengths and depths will be recorded to the nearest 0.1 foot. Monitoring point construction details will be noted on a Monitoring Point Installation Record form (Figure 3.4). This information will become part of the permanent field record for the site.

3.2.2.3 Above-Grade and At-Grade Well Completion

Each monitoring point will be completed with an at-grade protective cover. In areas where pavement is present, the at-grade cover will be cemented in place using concrete blended to the existing pavement; otherwise, a concrete pad will be installed around the monitoring point. The concrete immediately surrounding the monitoring point will be sloped gently away from the protective casing to facilitate runoff during precipitation events.

3.2.2.4 Monitoring Point Development

New monitoring points will be developed prior to sampling. Development removes sediment from inside the monitoring point casing and flushes fines from the portion of the formation adjacent to the monitoring point screen.

MONITORING POINT INSTALLATION RECORD					
JOB NAME EAKER AIR FORCE BASE		WELL	NUMBER		
JOB NUMBER			1		
DATUM ELEVATION					
DATUM FOR WATER LEVEL MEASUREMENT					
SCREEN DIAMETER & MATERIAL		SI	LOT SIZE		
RISER DIAMETER & MATERIAL					
GRANULAR BACKFILL MATERIAL					
DRILLING METHOD			•		
	VE	NTED CAP			
GROUND SURFACE —		VER			
CONCRETE —					
THREADED COUPLING -	- -				
		LENGTH OF SOLID			
		RISER:			
SOLID RISER			TOTAL DEPTH OF MONITORING		
		LENGTH OF SCREEN:	POINT:		
			·		
SCREEN —		SCREEN SLOT	:		
		SIZE: 0.01"			
CAP		LENGTH OF BACKFIL	LLED		
	-	BACKFILLED WITH: _			
		FIG	URE 3.4		
NC	OT TO SCALE	MONITO	RING POINT		
			TION RECORD		
		DV 6	Shonnette		
		BX Shoppette Intrinsic Remediation TS			
STABILIZED WATER LEVEL FE	ET	Eaker A	FB, Arkansas		
PARSONS ENGINEERING SCIENCE, INC.					
			r Colorado		

Monitoring point development will be accomplished using a peristaltic pump with dedicated tubing provided by Parsons ES. The pump tubing will be regularly lowered to the bottom of the monitoring point so that fines which have accumulated in the bottom are agitated and removed from the monitoring point.

Development will be continued until a minimum 10 casing volumes of water has been removed from the monitoring point and until pH, temperature, specific conductivity, DO, and water clarity (turbidity) stabilize. If the water remains turbid, monitoring point development will continue until the turbidity of the water produced has been stable after the removal of several casing volumes.

A monitoring point development record will be maintained for each point. The monitoring point development record will be completed in the field by the field scientist. Figure 3.5 is an example of the monitoring point development record. Development records will include:

- Monitoring point number;
- Date and time of development;
- Development method;
- Predevelopment water level and monitoring point depth;
- Volume of water produced;
- Description of water produced;
- Postdevelopment water level and monitoring point depth; and
- Field analytical measurements, including pH and specific conductivity.

P	age	of

Job Number: 722450.15 Location Eaker AFB - BX Shoppette Well Number	Job Name: <u>AFCEE Natur</u> by <u>TH\MV</u> Measurement Da	Date	
Pre-Development Information	Time (S	tart):	
Water Level:		Total Depth of Well:	
Water Characteristics			
Any Films or Immiscible pH	Clear Weak Moderat MaterialTemperature(°F °C)/ /cm)		
Interim Water Characteristics			
Gallons Removed		_	
pH		_	
Temperature (°F °C)		_	
Specific Conductance(µS/cm)		· -	
Post-Development Information	Time (F	inish):	
Water Level:	Total Do	epth of Well:	
Approximate Volume Removed:			
Water Characteristics			
Odor: None Any Films or Immiscible		te Strong	
pH Specific Conductance(μS	Temperature(°F °	°C)	_
Comments:		FIGURE 3.5	
		DEVEL ODMENT	DECORD

DEVELOPMENT RECORD

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Development waters from monitoring points will be collected in buckets at the site because low volumes of purge water are expected. Samples of the development water will be collected in 500- to 1,000-milliliter (mL) plastic or glass jars that are capped with foil and set at ambient temperatures for 15 minutes. A headspace reading of the development water sample will be taken with an organic vapor meter (OVM). Development water with a headspace reading less than 5 parts per million, volume (ppmv) will be released on the ground surface at the site. Development waters with organic vapor headspace readings above 5 ppmv will be collected and transported to the on-base landfarm for disposal.

3.2.2.5 Water Level Measurements

Water levels at existing monitoring wells and newly installed monitoring points will be measured within a short time period so that the water level data are comparable. The depth to water below the measurement datum will be measured to the nearest 0.01 foot using an electric water level probe.

3.2.2.6 Monitoring Point Location and Datum Survey

The location and elevation of the new monitoring points will be surveyed soon after point completion. The horizontal location will be measured relative to established Base coordinates. Horizontal coordinates will be measured to the nearest 0.1 foot. The elevation of the ground surface adjacent to the monitoring point casing and the measurement datum elevation (top of PVC casing) will be measured relative to the USGS msl datum. The ground surface elevation will be measured to the nearest 0.1 foot and the measurement datum, outer casing, and surveyor's pin (if present) elevation will be measured to the nearest 0.01 foot.

3.2.3 Site Restoration

After monitoring point installation and sampling is complete, each site will be restored around the finished monitoring point as closely as possible to its original condition. Both clean and contaminated development waters and sampling purge waters will be stored in 55-gallon drums or buckets. Development water will be disposed of as specified in Section 3.2.2.4.

3.3 GROUNDWATER SAMPLING

This section describes the scope of work required for collection of groundwater quality samples at existing groundwater monitoring wells, monitoring points, and well points. This section also details grab-sampling using peristaltic pumps inserted into the probe rods themselves to obtain single, discrete groundwater samples, if required. All groundwater samples will be obtained using a peristaltic pump and dedicated high-density polyethylene tubing (HDPE) where groundwater levels permit. In order to maintain a high degree of QC during this sampling event, the procedures described in the following sections will be followed.

Sampling will be conducted by qualified scientists and technicians trained in the conduct of groundwater sampling, records documentation, and chain-of-custody procedures. In addition, sampling personnel will have thoroughly reviewed this work plan prior to sample acquisition and will have a copy of the work plan available on site for reference.

The following list summarizes the activities that will occur during groundwater sampling:

Assembly and preparation of equipment and supplies;

- Inspection of the monitoring well or monitoring point integrity including:
 - Protective cover, cap, and lock,
 - External surface seal and pad,
 - Monitoring point ca, and datum reference, and
 - Internal surface seal;
- Groundwater sampling, including
 - Water level and product thickness measurements,
 - Visual inspection of sample water,
 - Monitoring point casing evacuation, and
 - Sample collection;
- Sample preservation and shipment, including
 - Sample preparation,
 - Onsite measurement of physical parameters, and
 - Sample labeling;
- Completion of sampling records: and
- Sample disposition.

Detailed groundwater sampling and sample handling procedures are presented in following sections.

3.3.1 Groundwater Sampling Strategy

Groundwater samples will be collected from previously installed monitoring wells and from monitoring points installed during this project. The existing wells and proposed monitoring point locations for sampling are identified in the following sections.

With the exception of wells TW1114 and TW1115, existing monitoring wells TW1101 through MW1128 will be sampled. At monitoring wells MW1124, MW1125, MW1126, MW1127, and MW1128, groundwater samples will be collected from the medium-grained sand unit located approximately 26 feet bgs. Shallow groundwater samples will be collected from the remaining wells. In addition, samples will be collected from the newly installed monitoring points.

3.3.2 Preparation for Sampling

All equipment to be used for sampling will be assembled and properly cleaned and calibrated (if required) prior to arriving in the field. In addition, all record-keeping materials will be gathered prior to leaving the office.

3.3.2.1 Equipment Cleaning

All portions of sampling and test equipment that will contact the sample matrix will be thoroughly cleaned before each use. This includes the CPT rods, water level probe and cable, lifting line, test equipment for onsite use, and other equipment or portions thereof that will contact the samples. Based on the types of sample analyses to be conducted, the following cleaning protocol will be used:

- Wash with potable water and phosphate-free laboratory detergent (HP-II detergent solutions, as appropriate);
- Rinse with potable water;

- Rinse with distilled or deionized water;
- Rinse with isopropyl alcohol; and,
- Air dry the equipment prior to use.

Any deviations from these procedures will be documented in the field scientist's field notebook and on the Groundwater Sampling Record (Figure 3.6).

If precleaned disposable sampling equipment is used, the cleaning protocol specified above will not be required. Laboratory-supplied sample containers will be cleaned and sealed by the laboratory. The type of container provided and the method of container decontamination will be documented in the laboratory's permanent record of the sampling event.

3.3.2.2 Equipment Calibration

As required, field analytical equipment will be calibrated according to the manufacturers' specifications prior to field use. This applies to equipment used for onsite measurements of oxygen, carbon dioxide, pH, electrical conductivity, temperature, alkalinity, reduction/oxidation potential, sulfate, sulfide, nitrate, nitrite, ferrous iron (Fe^{2+}) , total iron, ferric iron $[Fe^{3+} = (total iron) - Fe^{2+}]$, and manganese.

3.3.3 Sampling Procedures

Special care will be taken to prevent contamination of the groundwater and extracted samples. The two primary ways in which sample contamination can occur are through contact with improperly cleaned equipment and through cross-contamination due to insufficient cleaning of equipment between wells and monitoring points. To prevent such contamination, the water level probe and cable used to determine static water levels and

GKOOND	WATER SAMPLING RECORD - MONITORING	WELL	
	WATER SAINF LING RECORD - MONTORANG		(number)
REASON	FOR SAMPLING: [] Regular Sampling; [] Sp	ecial Sampling;	,
DATE AN	JD TIME OF SAMPLING: , 1996	a.m./p.m.	
SAMPLE	ND TIME OF SAMPLING:, 1996 COLLECTED BY: of		
WEATHE	`R·		
DATUM I	FOR WATER DEPTH MEASUREMENT (Describe)	۱ <u>:</u>	
MONITO	RING WELL CONDITION:		
	[] LOCKED:	[] UNLOCKED	
	WELL NUMBER (IS - IS NOT) APPARENT		
ť	STEEL CASING CONDITION IS:		
	INNER PVC CASING CONDITION IS: WATER DEPTH MEASUREMENT DATUM (TS - IS NOT) APPARENT	
	DEFICIENCIES CORRECTED BY SAMP	LE COLLECTOR	
	MONITORING WELL REQUIRED REPA	IR (describe):	
Check-off	•	- -	
1[]	EQUIPMENT CLEANED BEFORE USE WITH	H	
	Items Cleaned (List):		
2[]	PRODUCT DEPTH		FT. BELOW DATUM
	Measured with:		
	WATER DEPTH		F1. BELOW DATUM
	Measured with:		
	WATER-CONDITION BEFORE WELL EVA	CUATION (Describe):	
3 []			
3[]	Appearance:		
3[]	Appearance: Odor:		
3[]			
	Odor:Other Comments:		
3 [] 4 []	Odor:Other Comments: WELL EVACUATION:		
	Odor:Other Comments: WELL EVACUATION: Method:		
	Odor:Other Comments: WELL EVACUATION:		
	Odor:Other Comments: WELL EVACUATION: Method: Volume Removed: Observations: Water (slightly Water level (ros	- very) cloudy se - fell - no change)	
	Odor:Other Comments: WELL EVACUATION: Method: Volume Removed: Observations: Water (slightly Water level (ros	- very) cloudy se - fell - no change)	
	Odor:Other Comments: WELL EVACUATION: Method: Volume Removed: Observations: Water (slightly Water level (ros	- very) cloudy	
	Odor:Other Comments: WELL EVACUATION: Method: Volume Removed: Observations: Water (slightly Water level (ros	- very) cloudy se - fell - no change)	
	Odor:Other Comments: WELL EVACUATION: Method: Volume Removed: Observations: Water (slightly Water level (ros	- very) cloudy se - fell - no change) ts:	
	Odor:Other Comments: WELL EVACUATION: Method: Volume Removed: Observations: Water (slightly Water level (ros	- very) cloudy se - fell - no change) ts:	

GROUNDWATER SAMPLING RECORD

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		Monitor	ing Well No		(Cont'd)	
5[]	SAMPL	E EXTRACTION N	METHOD:			
		[] Pump, typ	scribe:			
		[] Outer, de.	5C110C			
		Sample obtain	ed is [] GRAB; [] COMPOS	ITE SAMPLE	
		_				
6[]	ON-SIT	E MEASUREMEN		36	tal.	
				Measured	with:	
		pH: Conductivity:		Measured	with:	,
			gen:	Measured	with:	
			al:	Measured	with:	
		Salinity:		Measured	with:	
		Nitrate:		Measured	with:	
		Sulfate:		Measured	with:	•
		Ferrous Iron:			with:	,
		Other:				•
						•
7[]	SAMPL	E CONTAINERS (material, number, siz	ze):		
						•
8[]	ONI SIT	E SAMPLE TREA	TMFNT:			
٥٤٦	ON-SI1	E SAIVII LLE TICET	1111111111			
	[]	Filtration:			Containers:	
			Method		Containers:	•
			Method		Containers:	•
		Preservatives :	nddad:			
	[]	Preservauves	added.			
			Method		Containers:	
			Method		Containers:	•
			Method		Containers:	•
			Method		Containers:	-
			٠.			
9[]	CONTA	AINER HANDLING	7.			
		[] Contair	ner Sides Labeled			
		[] Contair	ner Lids Taped			
•		[] Contair	ners Placed in Ice Cho	est		
10[]	OTHER	R COMMENTS:				-
						-
						•
					FIGURE 6.6 (6. Tools 10.1)	
					FIGURE 3.6 (Concluded)	
					GROUNDWATER	

SAMPLING RECORD

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total well depths will be thoroughly cleaned before and after field use and between uses at different sampling locations according to the procedures presented in Section 3.3.2.1. In addition to the use of properly cleaned equipment, dedicated HDPE tubing will be used at each sampling point, and a clean pair of new, disposable nitrile or latex gloves will be worn each time a different well or monitoring point is sampled. The following paragraphs present the procedures to be followed for groundwater sample collection from groundwater monitoring wells and monitoring points. These activities will be performed in the order presented below. Exceptions to this procedure will be noted in the sampler's field notebook and the groundwater sampling form.

3.3.3.1 Preparation of Location

Prior to starting the sampling procedure, the area around the existing wells and new monitoring points will be cleared of foreign materials, such as brush, rocks, and debris. These procedures will prevent sampling equipment from inadvertently contacting debris around the monitoring well/point.

3.3.3.2 Water Level and Total Depth Measurements

Prior to removing any water from the monitoring well or monitoring point, the static water level will be measured. An electric water level probe will be used to measure the depth to groundwater below the datum to the nearest 0.01 foot. After measuring the static water level, the water level probe will be slowly lowered to the bottom of the monitoring well/point, and the depth will be measured to the nearest 0.01 foot. Based on these measurements, the volume of water to be purged from the monitoring well/point will be calculated. If mobile LNAPL is encountered, the thickness of the LNAPL layer will be measured.

3.3.3.3 Purging Before Sampling

The volume of water contained within the monitoring well/monitoring point casing at the time of sampling will be calculated, and three times the calculated volume will be removed from the well/monitoring point. Clean and contaminated purge waters will be stored in 55-gallon drums or buckets. Water with a headspace reading less than 5 ppmv will be redistributed on the ground surface at the site. Water with headspace readings above 5 ppmv will be collected and transported to the on-Base landfarm for disposal

If a monitoring well/monitoring point is evacuated to a dry state during purging, the monitoring well/monitoring point will be allowed to recharge, and the sample will be collected as soon as sufficient water is present in the monitoring well or monitoring point to obtain the necessary sample quantity. Sample compositing or sampling over a lengthy period by accumulating small volumes of water at different times to obtain a sample of sufficient volume will not be allowed.

3.3.3.4 Sample Extraction

HDPE tubing and a peristaltic pump will be used to extract groundwater samples from the monitoring wells and well points. The tubing will be lowered through the well and 0.75-inch-outside diameter PVC monitoring point casing into the water gently to prevent splashing. The sample will be transferred directly into the appropriate sample container. The water will be carefully poured down the inner walls of the sample bottle to minimize aeration of the sample.

Unless other instructions are given by the analytical laboratory, sample containers will be completely filled so that no air space remains in the container. Excess water collected during sampling will be placed into 55-gallon drums used for monitoring well/monitoring point purge waters and transported for disposal by Base personnel to the on-Base facilities

3.3.4 Onsite Groundwater Parameter Measurement

As indicated on Table 3.1, many of the groundwater chemical parameters will be measured onsite by Parsons ES personnel. Some of the measurements will be made with direct-reading meters, while others will be made using of a Hach[®] portable colorimeter in accordance with specific Hach[®] analytical procedures. These procedures will be described in the following subsections.

All glassware or plasticware used in the analyses will have been cleaned prior to sample collection by thoroughly washing with a solution of Alconox® and water, and rinsing with deionized water and ethanol to prevent interference or cross contamination between measurements. If concentrations of an analyte are above the range detectable by the titrimetric method, the analysis will be repeated by diluting the groundwater sample with double-distilled water until the analyte concentration falls to a level within the range of the method. All rinseate and sample reagents accumulated during groundwater analysis will be collected in glass containers fitted with screw caps. These waste containers will be clearly labeled as to their contents and carefully stored for later transfer by Base personnel to the approved disposal facility.

3.3.4.1 Dissolved Oxygen (DO) Measurements

DO measurements will be made using a meter with a downhole oxygen sensor or a sensor in a flow-through cell. Measurements will be taken before and immediately following groundwater sample acquisition. When DO measurements are taken in monitoring wells/points that have not yet been sampled, the existing monitoring wells/points will be purged until DO levels stabilize. DO measurements will be recorded on the groundwater sampling record (Figure 3.6)

3.3.4.2 pH, Temperature, and Specific Conductance

Because the pH, temperature, and specific conductance of a groundwater sample can change significantly within a short time following sample acquisition, these parameters will be measured in the field in unfiltered, unpreserved, "fresh" water collected by the same technique as the samples taken for laboratory analyses. The measurements will be made in a clean glass container separate from those intended for laboratory analysis, and the measured values will be recorded in the groundwater sampling record (Figure 3.6).

3.3.4.3 Carbon Dioxide Measurements

Carbon dioxide (CO₂) concentrations in groundwater will be measured in the field by experienced Parsons ES scientists via titrimetric analysis using CHEMetrics Method 4500 (0 to 250 mg/L as CO₂). Sample preparation and disposal procedures are the same as outlined at the beginning of Section 3.3.4.

3.3.4.4 Alkalinity Measurements

Alkalinity in groundwater helps buffer the groundwater system against acids generated through both aerobic and anaerobic biodegradation processes. Alkalinity of the groundwater sample will be measured in the field by experienced Parsons ES scientists via titrimetric analysis using USEPA-approved Hach[®] Method 8221 (0 to 5,000 mg/L as calcium carbonate).

3.3.4.5 Nitrate- and Nitrite-Nitrogen Measurements

Nitrate-nitrogen concentrations are of interest because nitrate can act as an electron acceptor during hydrocarbon biodegradation under anaerobic soil or groundwater conditions. Nitrate-nitrogen is also a potential nitrogen source for hydrocarbon-degrading bacteria biomass formation. Nitrite-nitrogen is an intermediate byproduct in both ammonia nitrification and in nitrate reduction in anaerobic environments.

Nitrate- and nitrite-nitrogen concentrations in groundwater will be measured in the field by experienced Parsons ES scientists via colorimetric analysis using a Hach[®] DR/700 Portable Colorimeter. Nitrate concentrations in groundwater samples will be analyzed after preparation with Hach[®] Method 8039 (0 to 30.0 mg/L nitrate). Nitrite concentrations in groundwater samples will be analyzed after preparation with USEPA-approved Hach[®] Method 8507 (0 to 0.35 mg/L nitrite).

3.3.4.6 Sulfate and Sulfide Sulfur Measurements

Sulfate in groundwater is a potential electron acceptor for fuel-hydrocarbon biodegradation in anaerobic environments, and sulfide is resultant after sulfate reduction. The Parsons ES scientist will measure sulfate and sulfide concentrations via colorimetric analysis with a Hach[®] DR/700 Portable Colorimeter after appropriate sample preparation. EPA-approved Hach[®] Methods 8051 (0 to 70.0 mg/L sulfate) and 8131 (0.60 mg/L sulfide) will be used to prepare samples and analyze sulfate and sulfide concentrations, respectively.

3.3.4.7 Total Iron, Ferrous Iron, and Ferric Iron Measurements

Iron is an important trace nutrient for bacterial growth, and different states of iron can affect the oxidation/reduction potential of the groundwater and act as an electron acceptor for biological metabolism under anaerobic conditions. Iron concentrations will be

measured in the field via colorimetric analysis with a Hach[®] DR/700 Portable Colorimeter after appropriate sample preparation. Hach[®] Method 8008 for total soluble iron (0 to 3.0 mg/L ferric + ferrous iron) and Hach[®] Method 8146 for ferrous iron (0 to 3.0 mg/L) will be used to prepare and quantitate the samples. Ferric iron will be quantitated by subtracting ferrous iron levels from total iron levels.

3.3.4.8 Manganese Measurements

Manganese is a potential electron acceptor under anaerobic environments. Manganese concentrations will be quantitated in the field using colorimetric analysis with a Hach[®] DR/700 Portable Colorimeter. EPA-approved Hach[®] Method 8034 (0 to 20.0 mg/L) will be used to prepare the samples for quantitation of manganese concentrations. Sample preparation and disposal procedures are outlined earlier in Section 3.3.4.

3.3.4.9 Reduction/Oxidation Potential

The reduction/oxidation (redox) potential of groundwater is an indicator of the relative tendency of a solution to accept or transfer electrons. Redox reactions in groundwater are usually biologically mediated; therefore, the redox potential of a groundwater system depends upon and influences rates of biodegradation. Redox potential can be used to provide real time data on the location of the contaminant plume, especially in areas undergoing anaerobic biodegradation. The redox potential of a groundwater sample taken inside the contaminant plume should have a redox potential somewhat less than that taken in the upgradient location.

The redox potential of a groundwater sample can change significantly within a short time following sample acquisition and exposure to atmospheric oxygen. As a result, this parameter will be measured in the field in unfiltered, unpreserved, "fresh" water collected by the same technique as the samples taken for laboratory analyses. The measurements will be made as quickly as possible in a clean glass container separate from those intended for laboratory analysis.

3.3.5 Handling of Samples for Laboratory Analysis

This section describes the procedures for sample handling from the time of sampling until the samples arrive at the laboratory.

3.3.5.1 Sample Preservation

The analytical laboratory support personnel will add any necessary chemical preservatives prior to shipping the containers to the site. Samples will be prepared for transportation to the analytical laboratory by placing the samples in a cooler containing ice to maintain a shipping temperature of approximately 4 degrees centigrade (°C). Samples will be delivered to the analytical laboratory via overnight courier so that all sample holding times are met.

3.3.5.2 Sample Container and Labels

Sample containers and appropriate container lids will be provided by the analytical laboratory (see Appendix A). The sample containers will be filled as described in Section 3.3.3.2.4, and the container lids will be tightly closed. The sample label will be firmly attached to the container side, and the following information will be legibly and indelibly written on the label:

- Facility name;
- Sample identification;
- Sample type (e.g., groundwater);
- Sampling date;

- Sampling time;
- Preservatives added;
- Sample collector's initials; and
- Requested analyses.

3.3.5.3 Sample Shipment

After the samples are sealed and labeled, they will be packaged for transport to the mobile laboratory. The following packaging and labeling procedures will be followed:

- Package sample so that it will not leak, spill, or vaporize from its container;
 - Cushion samples to avoid breakage; and
 - Add ice to container to keep samples cool.

The packaged samples will be delivered by overnight courier to the analytical laboratory. Delivery will occur as soon as possible after sample acquisition.

3.3.5.4 Chain-of-Custody Control

After the samples have been collected, chain-of-custody procedures will be followed to establish a written record of sample handling and movement between the sampling site and the analytical laboratory. Each shipping container will have a chain-of-custody form completed in triplicate by the sampling personnel. One copy of this form will be kept by the sampling contractor after sample delivery to the analytical laboratory, and the other two copies will be retained at the laboratory. One of the laboratory copies will become a

part of the permanent record for the sample and will be returned with the sample analytical results. The chain-of-custody will contain the following information:

- Sample identification number;
- Sample collectors' printed names and signatures;
- Date and time of collection;
- Place and address of collection;
- Sample matrix;
- Chemical preservatives added;
- Analyses requested;
- Signatures of individuals involved in the chain of possession; and
- Inclusive dates of possession

The chain-of custody documentation will be placed inside the shipping container so that it will be immediately apparent to the laboratory personnel receiving the container, but will not be damaged or lost during transport. The shipping container will be sealed so that it will be obvious if the seal has been tampered with or broken.

3.3.5.5 Sampling Records

In order to provide complete documentation of the sampling event, detailed records will be maintained by the field scientist. At a minimum, these records will include the following information:

- Sample location (facility name);
- Sample identification;
- Sample location map or detailed sketch;
- Date and time of sampling;
- Sampling method;
- Field observations of
- Sample appearance, and
- Sample odor;
- Weather conditions;
- Water level prior to purging;
- Total monitoring well/monitoring point depth;
- Purge volume;
- Water level after purging;
- Monitoring well/point condition;
- Sampler's identification;
- Field measurements of pH, temperature, DO, and specific conductivity; and
 - Any other relevant information.

Groundwater sampling information will be recorded on a groundwater sampling form. Figure 3.6 shows an example of the groundwater sampling record.

3.3.6 Laboratory Analyses

Laboratory analyses will be performed on all groundwater samples and the QA/QC samples described in Section 5. The analytical methods for this sampling event are listed in Table 3.1. Prior to sampling, arrangements will be made with the analytical laboratory to provide a sufficient number of appropriate sample containers for the samples to be collected. All containers, preservatives, and shipping requirements will be consistent with USEPA protocol or those reported in Appendix A of this plan.

Analytical laboratory support personnel will specify the necessary QC samples and prepare appropriate QC sample bottles. For samples requiring chemical preservation, preservatives will be added to containers by the laboratory prior to delivery to the site. Containers, ice chests with adequate padding, and cooling media may be sent by the laboratory to the site. Sampling personnel will fill the sample containers and return the samples to the laboratory.

3.4 AQUIFER TESTING

Aquifer Slug tests will be conducted on selected existing wells to estimate the hydraulic conductivity of unconsolidated sand and clay deposits at the site. This information is required to accurately estimate the velocity of groundwater and contaminants in the shallow saturated zone. A slug test is a single-well hydraulic test used to determine the hydraulic conductivity of an aquifer in the immediate vicinity of the tested well. Slug tests can be used for both confined and unconfined aquifers that have a transmissivity of less than 7,000 square feet per day (ft²/day). Slug testing can be

performed using either a rising head or a falling head test; at this site, both methods will be used in sequence.

3.4.1 Definitions

- Hydraulic Conductivity (K). A quantitative measure of the ability of porous material to transmit water; defined as the volume of water that will flow through a unit cross-sectional area of porous or fractured material per unit time under a unit hydraulic gradient.
- Transmissivity (T). A quantitative measure of the ability of an aquifer to transmit water. It is the product of the hydraulic conductivity and the saturated thickness.
- Slug Test. Two types of testing are possible: rising head and falling head tests. A slug test consists of adding a slug of water or a solid cylinder of known volume to the well to be tested or removing a known volume of water or cylinder and measuring the rate of recovery of water level inside the well. The slug of a known volume acts to raise or lower the water level in the well.
- Rising Head Test. A test used in an individual well within the saturated zone to estimate the hydraulic conductivity of the surrounding formation by lowering the water level in the well and measuring the rate of recovery of the water level. The water level may be lowered by pumping, bailing, or removing a submerged slug from the well.
- Falling Head Test. A test used in an individual well to estimate the hydraulic conductivity of the surrounding formation by raising the water level in the well by insertion of a slug or quantity of water, and then measuring the rate of drop in the water level.

3.4.2 Equipment

The following equipment will be used to conduct a slug test:

- Teflon®, PVC, or metal slugs;
- Nylon or polypropylene rope;
- Electric water level indicator;
- Pressure transducer/sensor;
- Field logbook/forms; and
- Automatic data recording instrument (such as the Hermit Environmental Data Logger[®], In-Situ, Inc. Model SE1000B, or equivalent).

3.4.3 General Test Methods

Aquifer hydraulic conductivity tests (slug tests) are accomplished by either removal of a slug or quantity of water (rising head) or introduction of a slug (falling head), and then allowing the water level to stabilize while taking water level measurements at closely spaced time intervals.

Because hydraulic testing will be completed on existing wells, it will be assumed that the wells were properly developed and that water levels have stabilized. Slug testing will proceed only after multiple submerged pressure transducer measurements over time show that static water levels are in equilibrium. During the slug test, the water level change should be influenced only by the introduction (or removal) of the slug volume. Other factors, such as inadequate well development or extended pumping may lead to

inaccurate results; slug tests will not be performed on wells with free product. The field scientist will determine when static equilibrium has been reached in the well. The pressure transducer, slugs, and any other downhole equipment will be decontaminated prior to and immediately after the performance of each slug test using the procedures described in Section 3.3.2.1.

3.4.4 Falling Head Test

The falling head test is the first step in the two-step slug-testing procedure. The following steps describe procedures to be followed during performance of the falling head test.

- 1. Decontaminate all downhole equipment prior to initiating the test.
- Open the well. Where wells are equipped with water-tight caps, the well should be unsealed at least 24 hours prior to testing to allow the water level to stabilize.
 The protective casing will remain locked during this time to prevent vandalism.
- 3. Prepare the Aquifer Slug Test Data Form (Figure 3.7) with entries for:
 - Borehole/well number,
 - Project number,
 - Project name,
 - Aquifer testing team,
 - Climatic data,
 - Ground surface elevation,

Client AFCEE	Well No
Field Scientist MV\TH	Date
Total Well	
Elevation of Datum	
Temp	
	Total Well Elevation of Datum

Beginning Time	Ending Time	Initial Head Reading	Ending Head Reading	Test Type (Rise/Fall)	File Name	Comments
		·				
				ļ		
		 				
		1	l	1		

FIGURE 3.7

AQUIFER TEST DATA FORM

BX Shoppette Intrinsic Remediation TS Eaker AFB, Arkansas

PARSONS ENGINEERING SCIENCE, INC.

Denver, Colorado

- Top of well casing elevation,
- Identification of measuring equipment being used,
- Page number,
- Static water level, and
- Date.
- 4. Measure the static water level in the well to the nearest 0.01 foot.
- 5. Lower the decontaminated pressure transducer into the well and allow the displaced water to return to its static level. This can be determined by periodic water level measurements until the static water level in the well is within 0.01 foot of the original static water level or the submerged pressure-transducer indicates no pressure changes (indicating equilibrium).
- 6. Lower the decontaminated slug into the well to just above the water level in the well.
- 7. Turn on the data logger and quickly lower the slug below the water table, being careful not to disturb the pressure transducer. Follow the owner's manual for proper operation of the data logger.
- 8. Terminate data recording when the water level stabilizes in the well. The well will be considered stabilized for termination purposes when it has recovered 80 to 90 percent from the initial slug.

3.4.5 Rising Head Test

After completion of the falling head test, the rising head test will be performed. The following steps describe the rising-head slug test procedure.

- 1. Measure the water level in the well to the nearest 0.01 foot to ensure that it has returned to the static water level.
- 2. Initiate data recording and quickly withdraw the slug from the well. Follow the owner's manual for proper operation of the data logger.
- 3. Terminate data recording when the water level stabilizes in the well, and remove the pressure transducer from the well and decontaminate. The well will be considered stabilized for termination purposes when it has recovered 80 to 90 percent from the initial slug.

3.4.6 Slug Test Data Analysis

Data obtained during slug testing will be analyzed using AQTESOLVTM and the method of Hvorslev (1951) for confined aquifers or the method of Bouwer and Rice (1976) and Bouwer (1989) for unconfined conditions.

SECTION 4

REMEDIAL OPTION EVALUATION AND TS REPORT

Upon completion of field work, numerical and analytical groundwater models will be used to determine the fate and transport of fuel hydrocarbons dissolved in groundwater at the site. Based upon model predictions of contaminant concentration and distribution through time, and upon potential receptor exposure pathways, the potential risk to human health and the environment will be assessed. If it is shown that intrinsic remediation of BTEX compounds at the sites is sufficient to reduce the potential risk to human health and the environment to acceptable levels, Parsons ES will recommend implementation of the intrinsic remediation option. If intrinsic remediation is chosen, Parsons ES will prepare site-specific, long-term monitoring plans that will specify the location of point-of-compliance monitoring wells and sampling frequencies.

If the intrinsic remediation remedial option is deemed inappropriate for use at this site, institutional controls such as groundwater or land use restrictions will be evaluated to determine if they will be sufficient to reduce the risk to human health and the environment to acceptable levels. If institutional controls are inappropriate, remedial options which could reduce risks to acceptable levels will be evaluated and the most appropriate remedial options will be recommended. Potential remedial options include, but are not limited to, mobile LNAPL recovery, groundwater pump-and-treat, enhanced biological treatment, bioventing, air sparging, and *in situ* reactive barrier walls. The

reduction in dissolved BTEX that should result from remedial activities will be used to produce new input files for the groundwater models. The models will then be used to predict the BTEX plume (and risk) reduction that should result from remedial actions.

Upon completion of modeling and remedial option selection, a TS report detailing the results of the modeling and remedial option selection will be prepared. This report will follow the outline presented in Table 4.1 and will contain an introduction, site description, identification of remediation objectives, description of remediation alternatives, an analysis of remediation alternatives, and the recommended remedial approach for the site. This report will also contain the results of the site characterization activities described herein and a description of the models developed for the site.

TABLE 4.1 EXAMPLE TS REPORT OUTLINE BX SHOPPETTE INTRINSIC REMEDIATION TS EAKER AFB, ARKANSAS

INTRODUCTION

Scope and Objectives
Site Background

SITE CHARACTERIZATION ACTIVITIES

Sampling and Aquifer Testing Procedures

PHYSICAL CHARACTERISTICS OF THE STUDY AREA

Surface Features

Regional Geology and Hydrogeology

Site Geology and Hydrogeology

Climatological Characteristics

NATURE AND EXTENT OF CONTAMINATION

Source Characterization

Soil Chemistry

Residual Contamination

Total Organic Carbon

Ground Water Chemistry

LNAPL Contamination

Dissolved Contamination

Ground Water Geochemistry

Expressed Assimilative Capacity

GROUND WATER MODEL

Model Description

Conceptual Model Design and Assumptions

Initial Model Setup

Model Calibration

Sensitivity Analysis

Model Results

Conclusions

COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Remedial Alternative Evaluation Criteria

Long-Term Effectiveness

Implementability (Technical, Administrative)

Cost (Capital, Operating, Present Worth)

Factors Influencing Alternatives Development

Program Objectives

Contaminant Properties

Site-Specific Conditions

Brief Description of Remedial Alternatives

Intrinsic Remediation with Long-Term Monitoring

Other Alternatives

Evaluation of Alternatives

Recommended Remedial Approach

TABLE 4.1 (Concluded) EXAMPLE TS REPORT OUTLINE BX SHOPPETTE INTRINSIC REMEDIATION TS EAKER AFB, ARKANSAS

LONG-TERM MONITORING PLAN

Overview Monitoring Networks Ground Water Sampling

CONCLUSIONS AND RECOMMENDATIONS

APPENDICES: Supporting Data and Documentation
Site-Specific Bioplume II Model Input and Results

SECTION 5

QUALITY ASSURANCE/QUALITY CONTROL

Field QA/QC procedures will include collection of field replicates and duplicates and rinseate, field and trip blanks; decontamination of all equipment that contacts the sample medium before and after each use; use of analyte-appropriate containers; and chain-of-custody procedures for sample handling and tracking. All samples to be transferred to the analytical laboratory for analysis will be clearly labeled to indicate sample number, location, matrix (e.g., groundwater), and analyses requested. Samples will be preserved in accordance with the analytical methods to be used, and water sample containers will be packaged in coolers with ice to maintain a temperature of as close to 4°C as possible.

All field sampling activities will be recorded in a bound, sequentially paginated field notebook in permanent ink. All sample collection entries will include the date, time, sample locations and numbers, notations of field observations, and the sampler's name and signature. Field QC samples will be collected in accordance with the program described below, and as summarized in Table 5.1.

QA/QC sampling will include collection and analysis of duplicate groundwater and replicate soil samples, rinseate blanks, field/trip blanks, and matrix spike samples. Internal laboratory QC analyses will involve the analysis of laboratory control samples (LCSs) and laboratory method blanks (LMBs). QA/QC objectives for each of these samples, blanks, and spikes are described below.

TABLE 5.1 QA/QC SAMPLING PROGRAM BX SHOPPETTE INTRINSIC REMEDIATION TS EAKER AFB, ARKANSAS

QA/QC Sample Types	Collection/Analysis	Analytical Methods
Duplicates/Replicates	3 Groundwater and 2 Soil Samples (10%)	VOCs, TPH
Rinseate Blanks	1 Sample	VOCs
Field Blanks	1 Sample	VOCs
Trip Blanks	One per shipping cooler containing VOC samples	VOCs
Matrix Spike Samples	Once per sampling event	VOCs
Laboratory Control Sample	Once per method per medium	Laboratory Control Charts (Method Specific)
Laboratory Method Blanks	Once per method per medium	Laboratory Control Charts (Method Specific)

5-2

Only one rinseate sample will be collected at the site because dedicated tubing will eliminate the potential for cross-contamination due to improper decontamination of sampling tubing. Rinseate samples will consist of a sample of distilled water poured into or pulled through decontaminated or new sampling equipment and subsequently transferred into a sample container provided by the laboratory. Rinseate samples will be analyzed for VOCs only.

A field blank will be collected to assess the effects of ambient conditions in the field. The field blank will consist of a sample of distilled water poured into a laboratory-supplied sample container while sampling activities are underway. The field blank will be analyzed for VOCs.

A trip blank will be analyzed to assess the effects of ambient conditions on sampling results during the transportation of samples. The trip blank will be prepared by the laboratory. A trip blank will be transported inside each cooler which contains samples for VOC analysis. Trip blanks will be analyzed for VOCs.

Matrix spikes will be prepared in the laboratory and used to establish matrix effects for samples analyzed for VOCs. LCSs and LMBs also will be prepared internally by the laboratory and will be analyzed each day that samples from the site are analyzed. Samples will be reanalyzed in cases where the LCS or LMB are out of the control limits. Control charts for LCSs and LMBs will be developed by the laboratory and monitored for the analytical methods used.

SECTION 6

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APPENDIX A

CONTAINERS, PRESERVATIVES, PACKAGING, AND SHIPPING

REQUIREMENTS FOR GROUNDWATER SAMPLES

bin iii g						Recommended Frequency of	Sample Volume, Sample Container,	Field or Fixed-Base
Total organic SW9000 modified for accurate over the roluting environment and accurate over the roluting environment and 15 percent TOC may indicate the need for analysis of electron acceptors associated with that environment, the rate of ringation of petroleum contaminants in groundwater is dependent upon the amount of TOC in the sauree into groundwater is dependent upon the amount of TOC in the sauree into groundwater is dependent or amount of TOC in the sauree into groundwater is dependent or amount of TOC in the sauree into groundwater is dependent or amount of TOC in the sauree into groundwater is dependent or amount of TOC in the sauree into groundwater is dependent or amount of TOC in the sauree into groundwater is dependent or analysis of section are used to create a saureer analysis of saure in groundwater is dependent or analysis of section and sisting to addistribution of distribution or distribution of distribution or	Matrix	Analysis	Method/Reference	Comments	Data Use	Analysis	Sample Preservation	Laboratory
Carbon (TOC) Soil samples According over the content and content of soil samples ASTM D422 Astronometric order of soil sample content of soil sample and six of cleaton	oil	Total organic	SW9060 modified for	Procedure must be	Relatively high amounts of	At initial	Collect 100 g of soil in	Fixed-base
Trange of U. 2— Tentucing Entroposition and percent TOC analysis of electron analysis of electron analysis of electron analysis of electron contaminants in parameter is dependent upon the amount of TOC in the saturated zone soil; the rate of release of pertoleum contaminants from the saturated zone soil; the rate of release of pertoleum contaminants from the saturated zone soil; the saturated zone soil; the saturated zone soil; the source into groundwater is dependent (in part) on the amount of TOC in the source into groundwater is dependent (in part) on the amount of TOC in the source into groundwater is dependent (in part) on the source into groundwater is dependent (in part) on the amount of TOC in the source into groundwater is dependent (in part) on the amount of TOC in the source into groundwater is dependent (in part) on the source into groundwater is dependent (in part) on the source into groundwater is dependent (in part) on the amount of TOC in the source into groundwater is dependent (in part) on the amount of TOC in the source into groundwater is dependent (in part) on the source into groundwater is dependent (in part) on the amount of TOC in the source into groundwater is dependent (in part) on the source into groundwater is dependent (in part) on the source into groundwater is dependent (in part) on the source into groundwater is described instrument operating of distribution of depth and to infer the percent produced by the depth and to infer the percent produced by the percent		carbon (TOC)	soil samples	accurate over the	I OC may be indicative of a	sampining	Teflor-lined can: cool	
ASTM D-2216 Moisture ASTM D-2216 ASTM D-22				range of 0.5-	reducing environment and may indicate the need for		to 4°C	
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Carbon dioxide Carbon dioxide Contaminants Contaminants Contaminants Contaminants Contaminants Contaminants Contaminants Contaminants Contaminants Contaminants Contaminants Contaminants Contaminants Contaminants Contaminants Tound		distribution		a distribution of	hydraulic conductivity of	life of project	a glass or plastic	
Carbon dioxide Nondispersive infrared contaminants Carbon dioxide Mondispersive infrared content of soil assurant of soil approximately 0.1— degradation of biological degradation of hydrocarbons petroleum contaminants				grain size by	aquifer, and are used in		container, preservation	
Carbon dioxide Nondispersive infrared content of soil instrument operating gas carbon dioxide may be concentration gradient with approximately 0.1— perfoleum by the concentration gradient with degradation of produced by the concentration gradient with degradation of hydrocarbons petroleum contaminants				sieving	calculating sorption of		is unnecessary	
Carbon dioxide Nondispersive infrared Soil gas carbon Data used to understand Each sampling content of soil instrument operating dioxide may be the carbon dioxide round from the carbon dioxide concentration gradient with approximately 0.1— degradation of depth and to infer the petroleum biological degradation of hydrocarbons petroleum contaminants				•	contaminants			100000000000000000000000000000000000000
content of soil instrument operating dioxide may be the carbon dioxide over the range of produced by the concentration gradient with approximately 0.1—degradation of depth and to infer the petroleum biological degradation of hydrocarbons petroleum contaminants	Soil gas	Carbon dioxide	Nondispersive infrared	Soil gas carbon	Data used to understand	Each sampling	N/A	Field
approximately 0.1— degradation of l5 percent hydrocarbons	0	content of soil	instrument operating	dioxide may be	the carbon dioxide	round		
approximately 0.1— degradation of 15 percent petroleum hydrocarbons		gas	over the range of	produced by the	concentration gradient with			
petroleum hydrocarbons		o.	approximately 0.1-	degradation of	depth and to infer the			
hydrocarbons			15 percent	petroleum	biological degradation of			
				hydrocarbons	petroleum contaminants			

					Recommended Frequency of	Sample Volume, Sample Container,	Field or Fixed-Base
Matrix	Analysis	Method/Reference	Comments	Data Use	Analysis	Sample Preservation	Laboratory
Soil	Volatile organics	Gas chromatography/ mass spectrometry	Handbood method	Data is used to determine the extent of chlorinated	Each sampling round	Collect 100 g of soil in a glass container with	Fixed-base
		method SW8240.		solvent and aromatic hydrocarbon contamination,		Teflon@-lined cap; cool to 4°C	
				contaminant mass present,			
				and the need for source removal			
Soil	Dehydrogenase	Colorimetric	Reduction of added	An indicator of the	At the beginning of the project	Collect 100 g of soil in	Field
	enzyme activity	Kakaur-100	chloride by soil	presence or son microbes,	or me project	a giass comanici	
	(opuoliai)		microbes is	bioremediation to occur			
			measured				
			colorimetrically,				
			analyze immediately				
Soil	Aromatic	Purge and trap gas	Handbook method	Data is used to determine	Each sampling	Collect 100 g of soil in	Fixed-base
	hydrocarbons	chromatography (GC)	modified for field	the extent of soil	round	a glass container with	
	(benzene,	method SW8020	extraction of soil	contaminant mass present.		to 4°C	
	benzene, and		0	and the need for source			
	xylene [BTEX];			removal			
	isomers)						:
Soil	Total	GC method SW8015	Handbook method;	Data are used to determine	Each sampling	Collect 100 g of soil in	Fixed-base
	hydrocarbons,	[modified]	reference is the	the extent of soil	round	a glass container with	
	volatile and		California LUFT	contamination, the		Teflon-lined cap; cool	
	extractable		manual	contaminant mass present,		to 4°C	
				and the need for source			
				removai			

Field or Fixed-Base Laboratory		P	p p
Fiel Fixe Lab	Field	Field	Field
me, ainer, ervation			N/A Collect 100 mL of water in a glass container, acidify with hydrochloric acid per
Sample Volume, Sample Container, Sample Preservation			N/A Collect 100 mL of water in a glass container, acidify with hydrochloric acid per
	N/A	N N	N/A Collect water in containe hydroch
Recommended Frequency of Analysis	Each sampling round	Each sampling round	Each sampling round Each sampling round
Data Use	ith he	Soil gas methane can be used to locate contaminated soil and to determine the presence of anaerobic processes, see discussion of data use for methane in water	Data used to understand the petroleum hydrocarbon concentration gradient with depth and to locate the most heavily contaminated soils May indicate an anaerobic degradation process due to degradation of oxygen, nitrate, and manganese
Comments	The concentration of soil gas oxygen is often related to the amount of biological activity, such as the degradation of petroleum hydrocarbons; soil gas oxygen concentrations may decrease to the point where anaerobic pathways dominate	Methane is a product of the anaerobic degradation of petroleum hydrocarbons	Soil gas hydrocarbons indicate the presence of these contaminants in the soil column Field only
Method/Reference	Electrochemical oxygen meter operating over the range of 0–25 percent of oxygen in the soil gas sample	Total combustible hydrocarbon meter using a platinum catalyst with a carbon trap, and operating in the low parts per million volume (ppmv)	Total combustible hydrocarbon meter operating over a wide ppmv range Colorimetric A3500-Fe D
Analysis	Oxygen content of soil gas	Methane content of soil gas	Fuel hydrocarbon vapor content of soil gas
Matrix	Soil gas	Soil gas	Soil gas

					Recommended	Sample Volume.	Field or
					Frequency of	Sample Container,	Fixed-Base
Matrix	Analysis	Method/Reference	Comments	Data Use	Analysis	Sample Preservation	Laboratory
Water	Ferrous (Fe ⁺²)	Colorimetric	Alternate method;	Same as above	Each sampling	Collect 100 mL of	Field
		HACH Method # 8146	field only		round	water in a glass	
						container	
Water	Total Iron	Colorimetric	Field only		Each sampling	Collect 100mL of water	Field
		HACH Method # 8008			round	in a glass conatainer	
Water	Manganese	Colorimetric	Field only		Each sampling	Colect 100 mL of water	Field
)	HACH Method # 8034			round	in a glass conatiner	
Water	Chloride	Mercuric nitrate	Ion chromatography	General water quality	Each sampling	Collect 250 mL of	Field
		titration A4500-Cl ⁻ C	(IC) method E300	parameter used as a marker	round	water in a glass	
			or method SW9050	to verify that site samples		container	
			may also be used	are obtained from the same			
				groundwater system			
Water	Chloride	HACH Chloride test kit	Silver nitrate	Same as above	Each sampling	Collect 100mL of water	Field
		model 8-P	titration		round	in a glass container	
Water	Oxvgen	Dissolved oxygen meter	Refer to	The oxygen concentration	Each sampling	Collect 300 mL of	Field
			method A4500	is a data input to the	round	water in biochemical	30 30 20 20 30 30 30 30
			for a comparable	Bioplume model;		oxygen demand bottles,	
• • • • • • • • • • • • • • • • • • • •			laboratory	concentrations less than		analyze immediately;	
			procedure	1 mg/L generally indicate		alternately, measure	
				an anaerobic pathway		dissolved oxygen in situ	
Water	Conductivity	E120.1/SW9050, direct	Protocols/Handbook	General water quality	Each sampling	Collect 100-250 mL of	Field
		reading meter	methods	parameter used as a marker	round	water in a glass or	
				to verify that site samples		plastic container	
				are obtained from the same			
				groundwater system	1 K. See C. L. S. See C. S. S. S. S. S. S. S. S. S. S. S. S. S.		
Water	Alkalinity	HACH Alkalinity test	Phenolphtalein	General water quality	Each sampling	Collect 100mL of water	Field
		kit model AL AP MG-L	method	parameter used (1) as a	round	in glass container	
				marker to verify that all			
				site samples are obtained			
				from the same groundwater			
				system and (2) to measure			
				the buffering capacity of			
				groundwater			

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Field or Fixed-Base Laboratory	Field	Fixed-base	Field	Field Fixed-base	Field	Field
Sample Volume, Sample Container, Sample Preservation	Collect 250 mL of water in a glass or plastic container, analyze within 6 hours	Collect up to 40 mL of water in a glass or plastic container; cool to 4°C; analyze within 48 hours	Collect 100mL of water in a glass container	Collect 100mL of water in a glass container Collect up to 40 mL of water in a glass or plastic container, cool to 4°C	Collect up to 40 mL of water in a glass or plastic container; cool to 4°C	Collect 100 mL of water in a glass container, analyze immediately
Recommended Frequency of Analysis	Each sampling round	Each sampling round	Each sampling round	Each sampling round Each sampling round	Each sampling round	Each sampling round
Data Use	Same as above	Substrate for microbial respiration if oxygen is depleted	Same as above	Substrate for microbial respiration if oxygen is depleted Substrate for anaerobic microbial respiration	Same as above	Product of sulfate-based anaerobic microbial respiration; analyze in conjunction with sulfate analysis
Comments	Handbook method	Method E300 is a Handbook method, method SW9056 is an equivalent procedure	Colorimetric	Colormetric Method E300 is a Handbook method; method SW9056 is an equivalent procedure	Colorimetric	Colorimetric
Method/Reference	A2320, titrimetric, E310.2, colorimetric	IC method E300 or method SW9056; colorimetric, method E353.2	HACH method # 8039 for high range method # 8192 for low range	HACH method #8040 IC method E300 or method SW9056	HACH method # 8051	HACH method # 8131
Analysis	Alkalinity	Nitrate (NO ₃₋ 1)	Nitrate (NO3 ⁻¹)	Nitrite (NO Sulfate (SO ₄ ⁻²)	Sulfate (SO ₄ ²)	Dissolved sulfide (S ⁻²)
Matrix	Water	Water	Water	Water Water	Water	Water

					Recommended	Sample Volume,	Field or
					Frequency of	Sample Container,	Fixed-Base
Matrix	Analysis	Method/Reference	Comments	Data Use	Analysis	Sample Preservation	Laboratory
Water	Ethane, ethene	RSKSOP-114 (cont'd)	Ethane and ethene	Ethane and ethene are			
			are analyzed in	products of the bio-			
			addition to the other	transformation of			
			analytes only if	chlorinated hydrocarbons			
			chlorinated	under anaerobic conditions.			
			hydrocarbons are	The presence of these			
			contaminants	chemicals may indicate that			
			suspected of	anaerobic degradation is			
			undergoing	occurring			
			biological				
;			trititi			30 Jun 100 400	E. 2.1.4
Water	Carbon dioxide	HACH test kit model	Timmmenuc'	The presence of free car con	cacii sampinig		ricia
		CA-23 or CHEMetrics	alternate method	dioxide dissolved in	round	water in a glass	
		Method 4500		groundwater is unlikely		container	
				because of the carbonate			
				buffering system of water,			
				but if detected, the carbon			
				dioxide concentrations			
				should be compared with			
				background to determine			
				whether they are elevated;			
				elevated concentrations of			
				carbon dioxide could			
				indicate an aerobic			
				mechanism for bacterial			Tari Jari Jari
			Shared Shared Shared Shared	degradation of petroleum		jan (jangana)	

Field or Fixed-Base Laboratory	Fixed-base	Fixed-base	Fixed-base
Sample Volume, Sample Container, Sample Preservation	Collect water samples in a 40 mL VOA vial; cool to 4°C; add hydrochloric acid to pH 2	Volatile hydrocarbons- collect water samples in a 40 mL VOA vial; cool to 4°C; add hydrochloric acid to pH 2 Extractable hydrocarbons-collect 1 L of water in a glass container; cool to 4°C; add hydrochloric acid to pH 2	Collect 1 L of water in a glass container; cool to 4°C
Recommended Frequency of Analysis	Each sampling round	One time per year or as required by regulations	At initial sampling and at site closure or as required by regulations
Data Use	Method of analysis for BTEX, which is the primary target analyte for monitoring natural attenuation; BTEX concentrations must also be measured for regulatory compliance; method can be extended to higher molecular weight alkyl benzenes; trimethylbenzenes are used to monitor plume dilution if degradation is primarily anaerobic	Data used to monitor the reduction in concentrations of total fuel hydrocarbons (in addition to BTEX) due to natural attenuation; data also used to infer presence of an emulsion or surface layer of petroleum in water sample, as a result of sampling	PAHs are components of fuel and are typically analyzed for regulatory compliance; data on their concentrations are not used currently in the evaluation of natural attenuation
Comments	Handbook method; analysis may be extended to higher molecular weight alkyl benzenes	Handbook method; reference is the California LUFT manual	Analysis needed only for several samples per site
Method/Reference	Purge and trap GC method SW8020	GC method SW8015 [modified]	GC/mass spectroscopy method SW8270; high-performance liquid chromatography method SW8310
Analysis	Aromatic hydrocarbons (BTEX, trimethylbenzene isomers)	Total hydrocarbons, volatile and extractable	Polycyclic aromatic hydrocarbons (PAHs) (optional)
Matrix	Water	Water	Water

Matrix	Analysis	Method/Reference	Comments	Data Use	Recommended Frequency of Analysis	Sample Volume, Sample Container, Sample Preservation	Field or Fixed-Base Laboratory
Water	Total fuel carbon (optional)	Purge and trap GC method SW8020 modified to measure all volatile aromatic hydrocarbons present in the sample	A substitute method for measuring total volatile hydrocarbons; reports amount of fuel as carbon present in the sample; method available from the U.S. EPA Robert S.	Data used to monitor the reduction in concentrations of total fuel hydrocarbons (in addition to BTEX) due to natural attenuation	At initial sampling and at site closure	Collect 40 mL of water in glass vials with Teflon-lined caps; add sulfuric acid to pH 2; cool to 4°C	Fixed-base
Water	Volatile Organics	GS/MS method SW8240	Handbook method	Method of analysis for chlorinated solvents and aromatic hydrocarbons for evaluation of cometabolic degradation; measured for regulatory compliance when chlorinated solvents are known site	Each sampling round	Collect water samples in a 40 mL VOA vial; cool to 4°C; add hydrochloric acid to pH 2	Fixed-base
Water	Dissolved organic carbon (DOC) (optional)	A5310 C	An oxidation procedure whereby carbon dioxide formed from DOC is measured by an infrared spectrometer. The minimum detectable amount of DOC is	An indirect index of microbial activity	Each sampling round	Collect 100 mL of water in an amber glass container with Teflonlined cap; preserve with sulfuric acid to pH less than 2; cool to 4°C	Fixed-base
Water	Hd	E150.1/SW9040, direct reading meter	Protocols/Handbook methods	Aerobic and anaerobic processes are pH-sensitive	Each sampling round	Collect 100–250 mL of water in a glass or plastic container, analyze immediately	Field

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					Recommended	Sample Volume,	Field or
					Frequency of	Sample Container,	Fixed-Base
Matrix	Analysis	Method/Reference	Comments	Data Use	Analysis	Sample Preservation	Laboratory
Water	Temperature	E170.1	Field only	Well development	Each sampling round	N/A	Field
Water	Redox potential	A2580 B	Measurements	The redox potential of	Each sampling	Collect 100-250 mL of	Field
			are made with	groundwater influences and	round	water in a glass	
			electrodes; results	is influenced by the nature		container, filling	
			are displayed on a	of the biologically		container from bottom;	
			meter, samples	mediated degradation of		analyze immediately	
			should be protected	contaminants; the redox			
			from exposure to	potential of groundwater			
			atmospheric oxygen	may range from more			
			1	than 200 mV to less			
				than 400 mV			

- 1. "HACH" refers to the HACH Company catalog, 1990.
- Water and Wastewater, Standard Methods for the Examination of 1992. t 0 18th edition, refers 7
- U.S. Environmental to Methods for Chemical Analysis of Water and Wastes, Protection Agency, March 1979. "E" refers . ო
- "Protocols" refers to the AFCEE Environmental Chemistry Function Installation Restoration Program Analytical Protocols, 11 June 1992 . 당
- Handbook" refers to the AFCEE Handbook to Support the Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS), September 1993. "Handbook" 2
- and Chemical "SW" refers to the *Test Methods for Evaluating Solid Waste, Physical, and Methods*, SW-846, U.S. Environmental Protection Agency, 3rd edition, 1986. . 9
- "ASTM" refers to the American Society for Testing and Materials, current edition. 7.
- "RSKSOP" refers to Robert S. Kerr (Environmental Protection Agency Laboratory) Standard Operating Procedure. . ω
- "LUFT" refers to the state of California Leaking Underground Fuel Tank Field Manual 1988 edition. о О
- "Dissolved Oxygen and Methane in Water by a Gas Chromatography Headspace Equilibration International Journal of Environmental Analytical Chemistry, Volume 36, pp. 249-257, Technique," by D. H. Kampbell, J. T. Wilson, and S. A. Vandegrift. 10.

APPENDIX B ADDITIONAL SITE DATA

APPENDIX B - 1A

SOIL BOREHOLE LOGS

BX SHOPPETTE

Source: Halliburton NUS 1992, 1994, and 1995.



7	RECOVERED	7.	E NUMBER	PLE NUMBER	INU SCAN FILE OF THE OF	CODE	DEPTH (PEET)	re Ap	PROJECT 3K98 BORING NO. EAKER BA TWILD! JOB NO. 3K98 LOGGED BY: JSB. PROJ. MGR. GVG EDITED BY: BFN DRILLING COMPANY: A.W POOL DRILLING METHOD: HOLLOW STEM AUGER DRILLERS NAME: VINCE BARAZA TOTAL DEPTH (FT.) 3D' TIME TIME COMPLETED D 827 DATE COMPLETED D 827 DATE COMPLETION OF DRILLING GROUND-WATER CONDITION AT COMPLETION OF DRILLING GROUND-WATER CONDITIONS CROUNDWATER AT 19' ON CORE BARDEZ BACKFILLED, SEE WELL DATE WEATHER CONDITIONS CLEAR, COOL, 40°
7		7.	LABORATORY E NUMBER	E NUMBER	SCAN	21907		re Ap	JOB NO. 3K98 LOGGED BY: 153 PROJ. MGR. GVG EDITED BY: BFN DRILLING COMPANY: A.W POOL DRILLING METHOD: HOLLOW STEM AUGER DRILLING METHOD: HOLLOW STEM AUGER DRILLERS NAME: VINCE BARAZA TOTAL DEPTH (FT.) 30' TIME STARTED 0735 DATE STARTED 0735 DATE COMPLETED 0877 DATE GROUND-WATER CONDITION AT COMPLETION OF DRILLING GROUNDWATER AT 19' ON CORE BALVEZ BACKFILLED, SEE WELL DATE WEATHER CONDITIONS
7			LABORATORY E NUMBER	LABORATORY C	SCAN	21907	TH.	PeAp	PROJ. MGR. GVG EDITED BY: BFN DRILLING COMPANY: A.W POOL DRILLING METHOD: HOLLOW STEM AUGER DRILLERS NAME: VINCE BAFAIZA TOTAL DEPTH (FT.) 30' TIME STARTED 0735 DATE 12/11/11 GROUND-WATER CONDITION AT COMPLETION OF DRILLING GROUNDWATER AT 19' ON CORE BALVEZ BACKFILLED, SEE WELL CAMPLETTON FORM WEATHER CONDITIONS
7			LABORATORY E NUMBER	LABORATORY C	SCAN	21907		Persp	DRILLING COMPANY: A.W POR L DRILLING METHOD: HOLLOW STEM AUGER DRILLERS NAME: VINCE BAFAIZA TOTAL DEPTH (FT.) 30' TIME STARTED 0735 DATE COMPLETED 0877 DATE COMPLETED 0877 DATE COMPLETED 0877 DATE COMPLETED 0877 DATE COMPLETED 0877 DATE COMPLETION OF DRILLING GROUNDWATER CONDITION AT COMPLETION OF DRILLING GROUNDWATER AT 19' ON CORE BARREZ BACKFILLED, SEE WELL COMPLETION FORM WEATHER CONDITIONS
7			LABORATORY E NUMBER	LABORATORY C	SCAN	21907	TI (III	Perp	DRILL RIG TYPE: MOBILE B-61 DRILLING METHOD: HOLLOW STEM AUGER DRILLERS NAME: VINCE BAFAZZA TOTAL DEPTH (FT.) 30' TIME STARTED 0735 DATE COMPLETED 0877 DATE COMPLETED 0877 DATE COMPLETED 0877 DATE COMPLETION OF DRILLING CROWNDWATER AT 19' ON CORE BACKEZ BACKFILLED, SEE WELL COMPLETION FORM WEATHER CONDITIONS
7			LABORATORY O	LABORATORY CONTRACTOR OF THE NUMBER	SCAN	21907	TH ET)	Perp	DRILLING METHOD: HOLLOW STEM AUGER DRILLERS NAME: VINCE BARAZA TOTAL DEPTH (FT.) 30' TIME STARTED 0735 DATE COMPLETED 0827 DATE COMPLETED 0827 DATE COMPLETED 0827 DATE COMPLETION OF DRILLING GROUNDWATER AT 19' ON CORE BARAZE BACKFILLED, SEE WELL COMPLETION FORM WEATHER CONDITIONS
7			LABORATORY E NUMBER	LABORATORY CONTRACTORY CONTRACTORY	SCAN	21907	TH ET)	P. P. P. P. P. P. P. P. P. P. P. P. P. P	TOTAL DEPTH (FT.) 30' TIME STARTED 0735 DATE COMPLETED 0827 DATE COMPLETED 0827 DATE COMPLETION OF DRILLING GROUNDWATER AT 19' ON CORE BALLEZ BACKFILLED, SEE WELL CAMPLETTEN FORM WEATHER CONDITIONS
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7			LABORATORY E NUMBER	LABORATORY CONTRACTORY CONTRACTORY	SCAN	21907	TH ET)		TIME STARTED 0735 DATE 12 11 41 TIME COMPLETED 0877 DATE 12 11 19 1 GROUND-WATER CONDITION AT COMPLETION OF DRILLING CROUNDWATER AT 19 ON LORE BALLET TIME BACKFILLED, SEE WELL CAMPLETICK FORM WEATHER CONDITIONS
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7			LABORATORY E NUMBER	LABORATORY E NUMBÉR	SCAN	21907	TH ET)		GROUND-WATER CONDITION AT COMPLETION OF DRILLING CROWNDWATER AT 19' ON CORE BACKET BACKFILLED, SEE WELL COMPLETED TO FORM WEATHER CONDITIONS
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	3%		187			- w					
]		1 7		Se 130	7.50	300	- T			CLAY AS ABOVE, GREY-BROW W/ OXIDE
) N		- 		ુ				П-		POSICUES MOTTUED : STIFF MED SIN
	~	1			0	721103	30 %	Ct			- PERSTIC, TRACE SILT
	306.7	1		4		1 3	m g 20	c	H		
	1 3	1	1	4005	,	1	19		9		
	Twa:) {		"	6110	F11 - Su	(,01)		-		
	10	i	ı	i	1 (11	1 20	ı, i	و لما	01	

	FI	ΞL	D) <u>G</u>	0	F	<u> 30</u>	RI	N(G (CONT'D.) SHFET 20F2
	SAMPLER TYPE	FEET DRIVEN	FEET RECOVERED	SAMPLE	FIELD LAB. Sample no.	-Ju	194	L/THOLOGIC CODE	DEPTH (FEET)		PROJECT BORING NO. EAKER BX JOB NO. 3K98 TW1103
							200	12111	П	- 1	
Court Spelt	12-17	5	5	6000	£1103-3@1311	Heom 14'	10	152 CL/CH) 3 -) 4 -) 5 - 6	1	CLAT AS ABOVE; BELONES STIFFER AND MOTTUNE IS MURE APPARENT
CONTINUORS	SPLIT SPUDI)	ري دي	り	enerient	E1103-46 1918	(30.)	2 , ,	C L	18 19 20 21		CLAY AS ABOVE; GREY BELOW 17' NO MOTTLING MOTTLED ZONE 19-20' CLAY IS SOFT AT BOTTOM 21-22'
OPNTINUOUS	SPUT SPOON	5	5	CECEUENT	158 12/11/41 E1108 =		0 0 0 0	C.L.	2.3 2.4 2.5 2.6		WATER ON WIE BARREL & 72' CLAY, AS AGOVE THE SILT BLUE-GREY WIMOTTLING; DK GREY BELOW 26'
STRAIGHT	27-30	1	1	1			1		28 29 30 1 2 3 4		TD = 30'
두 7 호 ·	NO7	TES:		2					7		



E	TE		DI	<u>م</u>	G	OF	E	301	RII	NG	SHEET 1 OF 2
F	PLAI	N			-						PROJECT BORING NO.
				GRA	< <				1/	1	EAKER BX TW1104
	-	. n2	_	برب _ا و	(O)	TN	140	ı		j	JOB NO. 3K98 LOGGED BY: 15B
ŀ	TW!	102			<u> </u>					┪.	PROJ. MGR. GV G EDITED BY: BFN
ŀ							••) _{*2}	DRILLING COMPANY: AW POOL
										170	DRILL RIG TYPE: MUSSIE, 13-61
										(=	DRILLING METHOD: HOLLOW-STEM AUGER
								Tω	1104)	DRILLERS NAME: V. BARRAZA
				(/	3 T	· ·)			o '		TOTAL DEPTH (FT.) 30
				2 1 1		ب ار					TIME 12 11 91 MEE -58 (1439) V
ļ											COMPLETED 1500 DATE 12 1/6/
i		Ì			£	¥~					GROUND-WATER CONDITION AT COMPLETION OF DRILLING SATURATED ZWE 18.5' and ± 19'
					RATORY	ATC					
l	_		읍	Z	o = 1		Z	000			BACKFILLED. DATE (SEE COMPLETICE WEATHER CONDITIONS
	E ER	z	E E	백원	Şщ	A H	SCAN		EC		WEATHER COMMITTONS
ŀ	YPE	FEET	LS.	SAMP	SAMP	FIXED	HNU S	동품	DEPT (FEE		CLEAR, WARM 60°
	38	FP	EE!	အပ	ES	正分	±e	22	<u> </u>		SURFACE ELEVATION
	74								H	※	COMMENTS ASPHALT AT SURFACE
	AW6 EK 0-2	っ				1)		Н,	ه .	
	03	2		(1	l	'	GC	H	٠	FILL TO 2' GRAVERLY CLAY
									2		0-Z Fill
		:					0		Н		6.04 24 60 1 66 60 1 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7
, 1									3		MED. STIFF PLASTIC: TR SILT +
1							5		H		MEDISTIFF PLASTIC , TR SILT +
								C4	H		2-8 CLAY
				5,7		j	5	CH	H	- ~	7 8 651
	7	15	り	3			,		5		
	2			Excer	}				Н	-	
3				E			5		He	-	
	-	زوخدا		-3			7				
2,0											
0	3	-		F.	20	-	8				CLAY, BROWN , VERY MOIST ; MED. STITE
,	12			Excerient	-	3		50/		: · · ·	PLASTIC; TR SILT + SD; NOTHED
, 1	4 ~	15	17	Ell	7	14.55	6	500		F	GREENISH - GREY TO RUST LOWIED;
. (- ;	7			72	fo113	β			9		SDY ZONE 8-8.5'
1222129		İ		E	(u)					J	
5	1	•	•	•	•	•	•	•	-10	, •	The state of the s

<u> </u>	-11	EL	<u>D</u>		<u>)G</u>	0	F	<u>BC</u>	R	<u>IN</u>	G (CONT'E).) SHEET 2 OF 2
	SAMPLER TYPE	FEET DRIVEN	FEET RECOVERED	SAMPLE CONDITION	FIELD LAB. SAMPLE NO.		HNUSCAN (PPM)	LITHOLOGIC	DEPTH (FEET)		PROJECT EAKER BX JOB NO. 3K98	BORING NO. TWILO4
							8		1/1		F.S - 12 CAY AS AB	0.7 E
Con House	21-21	5	5	Excenent	!)	4 5	C.14	13	I		VE; SILTY CIAY WINE
Supractions	27	5	5	EXCELLENT.	E 1104-2 (20)	(4) (506)	2 3 2	SC	18	- '		DVE: LT BLOWN BELOW SANDIETE ZONE T 19'
		SS No	B ARI	26°L 30°	CAM	from			23 24 25 26			
									27 96 19		TD = 30	
					·				- 1 - 2 - 3			
		- P	. :	- WAT 4					5 6 7			
	IOT	ES:	7	n usséelle	in The Las				9			



_			JL	-	י ט	OF			711	70		SHEET 2 OF 2
-	PLAN										PROJECT	BORING NO.
1	_	<u></u>	<u>طعر</u>			. VS	, 71 c	ر س <u>اع</u> ا	el		EARER: BX site	TW1105
		-		TWIL			, , 	1			JOB NO. 3K98	LOGGED BY: BFN
	_		•	10-110			_	 -	- _i		PROJ. MGR. GYG	EDITED BY: JSS
			! !	CA	, D	.	1	A		. If		1001
			1	C4202	4 6	1	,	ALUS		- 1	DRILL RIG TYPE: M	dile \$61
				y	צישאוני	Ì				1 1		llarsten Aviers
			٠.	!	E 5		l.					Bustozza ·
			•		٠,		•				TOTAL DEPTH (FT.)	25
											TIME STARTED 0725	DATE 12/13/9/
										i i	TIME COMPLETED 0803	DATE 12/13/91
-	1	ī		1	- -	> 1					COOLING WATER CONDITIO	N AT
į					55	E					COMPLETION OF DRILLING	z15 feet
					MA	FIXED LABORATORY SAMPLE NUMBER		()			BACKFILLED,	DATE - (SEE COMPLETION A
	œ		띭	2	율뢰	FIXED LABOR SAMPLE NUM	Z	LITHOLOGIC CODE			TIME WEATHER CONDITIONS	<u> </u>
		2	. 필	벌		급	25 <u> </u>) 	ΞF		WEATHER CONDITIONS Cloudy, Cool & 48	
	AMPLER YPE	₽Ş		到			₽₽	EB	DEPTH (FEET)		SURFACE	
	18	40	EE	<u> </u>	正の	正必	王	70		₹ %	SURFACE ELEVATION COMMENTS	
									H	: 0	Asphalt at	
,	-		•						H,		0.0 to C	
				ļ					Н		•	clast mixed some
									12		fines 0.2	toic'
	!							SW	Н	· . :		
	;								H3		Fill: Sand	median to Course
	1						7,000			1.	Somined	
							1		4	'	non plastice	Strong Hydrococker edos
	13					•			Ц	:	1.0 - 7.5	
	BAPLE								45	-		
	10				5		750	CP	Ц	1.	* Original soil	
	11/0	2.0	1	ا م	3	11			46	1	Sundy Clay 10	ever Francis Stayis
	51.5	6	ró	FAIR	4	'			Ц		brown so-dis	tine crained
		-	-		÷	-	-		-1-4-2		<u> </u>	moist, medius
							1		I		51:4, slightly	plastic.
	-	1	1	1	5 July 10 2005		1		8	-	7.3	46 13.0
	3	-	-	* [* 5 5 5 1 \$		I				1 .		
	+3			· 현 회사선호	N		750		Ц			
	70000			* [현리에서 호	2.2		754	SC	15			
	+3	0	9	1	7405-2	1	750	Sc		- T		

FI	EL	.D	L()G	0	F	30	RI	N(G (CONT'D.) SHEET Z OF Z
					Π.					PROJECT BORING NO.
E.	_	ERE	™S NS	LAB.	P P	AN	-06K			JOB NO. 3×98 EIITUOS
SAMPL	FEET DRIVEN	FEET RECOVERED	SAMPL	크로	B	SS(¥	E H	F E		37 /B E/// acc
SAI	FR	EE	S S S S S	FIE	FIX	Ha Fa	Eg	DEP FIED		
ļ						25000		Ŭ ,	-	
							S.c	2		
								3		
L N						>540	~ . I	4		suprated at 15's material from 12.17' same as above
3,2017	5.0	\	FOR	1	1		ś₩	15	∇	Sord: stay medius stained
4	۶	2.7	Z.			>500		6	·	moist tonet losse.
				εV				В	1.	13 00 to 17.0'
			pre	,eV	5			9	 	
							SC	20		
	4	PARA PARA	ξζ.,					┤ ′		Sandy Clay; brown, moist, median etiff, to soft, moderathy plastic
	ه<	S. Car.						2	- · 	mottled.
								25		
								6		TD:25'
								7		
								8		
								9		
		*						2		
								- 3		
								4		
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-	. 1 1 m									
			. 14.20							
NOT	 							∃ -0		A CONTRACTOR OF A CONTRACTOR O
TOM	∟ 3∙									

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F	FIE	L) l	_0	G	OF	E	108	711	NG	SHEET OF
_	LAN							,			PROJECT BORING NO.
j		•									EIITW 1106
				<u> </u>	 -			Tมเ Ø	103		EAKEL AFR EHTWOOF JSG
- 1-							1.	୍ବା ^ଆ ଡ			JOB NO. 3K9B LOGGED BY: BFAI PROJ. MGR. C. C. EDITED BY:
				r				-			400
ŀ			_	_)	•	(: }	K UHO		DRILLING COMPANY: POOL
						(D) Tw	1105	18	ž		DRILL RIG TYPE: Molife , 861
1		•		MEIDI	AN @		>	Euti	သုတ္		DRILLING METHOD: Hollow them Austral
					TW:	ίιο <i>ς</i> 		0 1	ù		TOTAL DEPTH (FT.) 25
-		_		GRAS	© _					1	IDATE
			,	رهاده <u>ح</u>	s jv	31101		i		1	STARTED 0936: 12/13/9/
<u>_</u>											GROUND-WATER CONDITION AT
1					E E	R R					COMPLETION OF DRILLING Saturated at 16.5 undat 9.0
					==:						i
		FEET DRIVEN	밃	z	ABORA E NUMB		z	วเอดา			TIME SEE COMPLETION FORM
	ER	Z	VER	뜨읩			CAN	97	ΞC		WEATHER CONDITIONS Partly classy, lite. breeze, cool
	图	<u>5</u>	-0 -0	F 2	HΩ	FIXED SAMPL	HNU S (PPM)	LITHOL CODE	DEPT		
	ST	표		80	SA	E&	至	38	100	1	SURFACE ELEVATION
		1		1					Ц	₹	COMMENTS
ļ	1 62.5		·				,		∐,		Asphalt at Surface 1-0-03'
	5 5 E	0	0		1	1		•	∐′	, -	Fill Crave Inixed ultimes
	· ·									EM	
ļ								ML	∐ <u> </u>		Fill: 5:14 Chy lane scay, moist
	. i						60		<u> </u>	-	sitt , w/some small concreations
					-			Ì	∐ [™]	115	0.3 to 3.5
	1										
	2									1	Sith Clay son khosen alsing
	OAKE						0			11-	Sand most medicastill
	K							\	Π°	1-1-	ortsome existe modules stockthe
	170							ML	\prod_{-}	-1	incolled.
	15	5	0	5000		1		1	He	11,	3:5 to 20
	8	i i	, M	, N			50			些	
		-		-	-						Sand clay Trlover Sand brown
 					. 1254.21						
	Sare,							100	8	_	to say bones, must to be
	100						0	SC	Ή	-	in zones, Suid in the Committee
	117	0	0	1		.			و	1	710 40 10 0
	12,5	1 5	1 5	j		/	6		H-	1.	
	4	1			1		1 '	1	Ц.		

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	FII	ΞL	D)G	01	F	30	RI	NO	G(C)	CONT	D.)	SHEET COF 2	ì
	SAMPLER	FEET DRIVEN	ERED	SAMPLE	FIELD LAB. SAMPLE NO.	KED LAB. MPLE NO.	HNUSCAN (PPM)	LITHOLOGIC	-DEPTH (FEET)	•	PROJECT 151			BORING NO.	
_	5 ' Safe & Salvine / Salvi	5.0	ع.د.	ا در در در در در در در در در در در در در د	/	1	0 0	CL	3 4 5	CHAN BOSE	me	ustraity,	<u>slist</u> 16.5	ulsine sundisit	
	3.30114 BANNOC	5:0	8:0	نهدرمر	1	/	0 0	sw	8 9 20 21			more clos Soul see	isy 	16.5' + 17' closes	
		0 7. S. S. S. S. S. S. S. S. S. S. S. S. S.	June 1	the state of the s	h			CL	2.3 2.4 2.5 6	1 11 11 11		must to	ert mus to 2	to brownish stay soft, por plastic t of alay 1.0 oxey sund Groybrus	
										7 7 8 8		nuist, s	s b.	medium st. ff reatly increases af 22 Me Into Clayed , st. ff, plastic	
:=	÷ •			AMMA								TD = 2.5'			



F	IE) ו	0	G	OF	E	108	RI	NG	SHEET 1 OF 2
	LAN			.,							PROJECT BORING NO.
İ									_		EAREN AFR EITWOT
	•					2	itori	'ETT	اء		JOB NO. 3K98 LOGGED BY: UNE
		1	112	101			•	U			PROJ. MGR. GVG EDITED BY: SFN
	\										DRILLING COMPANY: A.V. POOL
. 6		_		١.		\			ر		DRILL RIG TYPE: & ST. 8-61
		N N) (TOU To						DRILLING METHOD: House Sten Augen
	2	8 3			SCAU		0				DRILLERS NAME: VINCE BARKAZZO
4 2 4		NDEROY	$\overline{}$)		1	٠ م				TOTAL DEPTH (FT.) 30'
9		3				1		,			TIME STARTED 1515 DATE 12/13/94
		1									COMPLETED 1600 DATE 12/13/91
i				i	≥_	ORATORY JMBER					GROUND-WATER CONDITION AT
	.				BEG	MERC			 .		COMPLETION OF DRILLING parrel sufa matel at \$221
			9		LABORAT	SS		210			BACKFILLED, DATE
	ב ע		EB		AM	BA Ba	CAN	907			WEATHER CONDITIONS
	TYPE	FEET DRIVEN		SAMPLE	크로	FIXED	HNU S (PPM)	THOLOGIC ODE	DEPTH		PARTY CLOUDY 5 MPW WAR 55°F
	Z Z	뿐		800	SAIS	SAS	<u> </u>	<u> </u>	12.		SURFACE ELEVATION
1									Ц	X	COMMENTS
									Ц,	1:	ASPHALT @ SUNFACE
	100	2.0	-	-	-	-			Ц	٢	0-3:5, Asphalt + Fill
									∐2	FM	
-	!						7500		Н	-	• .
į									HJ	-'-	arti di a
١	7							Ì		-	3.5-6.5'; CLAYEY SAND + SANDY CLAY,
	BARGEL			ل ا) -			SW.	4	-,-	AUTENATINE, SAND -COARSE BRE
	D A			3	10		X500	156	H		GRAINED; CLAY - MODERATELY
		5.0	3.5	3	E11Two7	-			5	\-\\\-\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	SUPE DAME BROWN.
	Speit			EXCE.	=				H		Moist
	SP			k W	Ú				6		6.5-10.5. CLAYEY SAND YREY,
ات					 		×500	<u> </u>			Giston Conjeg Chois grey
1		-=	7			-			1	- 7-1	met.
			-				1500	ع کے ا			
	را			CENTENT					1	' '.	-
	ي ا		_	14	_	-					
	SPLLA	٥٠٥	5.0	7			3500	59	M	'	
	120	1	1	l iu	1	1	1	l	<u> </u>	- []	

THE PROPERTY OF THE PARTY.

FII	EL	D	L()G	01	F	30	RI	N	G (CONT'D.) SHEET 2 OF 2
SAMPLER TYPE	FEET Driven	FEET RECOVERED	SAMPLE	ш	FIXED LAB. SAMPLE NO.	•	LITHOLOGIC	DEPTH (FEET)		PROJECT BORING NO. ENTER EITHIOT JOB NO. 3K98 ENTER THE
	SER	PKE	v. 1	N GE		po	CL	11	- - -	10.5-21.0-BROWN-GREY CLAY, hard, plastic, mottled
STU F BARAEL	0.0	8.0	Excelen	_	3	500 2000	PCi+	(3 14 15 16		
SPUR	S. O	8.0	E KCE LUENT	E11-TWD7-02	_	1500 7500		17 18 19 20 21	(21.0-22.0; SANDY CLAY, Scft, brown, saturated.
	S.5	1	1		-			24	-	MED. TO
R IT	3.0	1	1	١	-			-27 -28 -29	7	BETWEEN 22-30 - COARSE TAND ALTERNATING WI MOD HARD, DATHLE GREY CLAY, MOSTLY CLAY HORIZONS,
		- N-2 (2)							,	



FI	E	L) L	0	G	OF	8	OF	711	NG	SHEET OF
PL	AN					Shore	EME				PROJECT BORING NO.
$\parallel \parallel$						S por ,	, -	(6	'um	<u>~</u> ;	EAKER AFB ETTWOSFR
1	-			~ .		- C					PROJ. MGR. GVG EDITED BY: BFN
				FII	TW	0 0			Pum	<u> </u>	A 2
											DRILLING COMPANY: A.W. POOL DRILL RIG TYPE: B-81.61
	2										DRILLING METHOD: HOLOW STEM AUGERS
-11 -									PUM	ا ــــ	DRILLERS NAME: VINCE BARRAZZO
	d										TOTAL DEPTH (FT.) 29
11.	-										TIME 0745 PL DATE 12/14/91
	ノ										TIME COMPLETED 0825 DATE 12/14/91
					٨.	34					TARGETT CONTINUES OF THE PROPERTY OF THE PROPE
						ATORY SER					COMPLETION OF DRILLING SATURATED ZANES 4 1 10' and 21'
					ABOR	BORA	_	ပ			TIME DATE 12-18-9/
8			E		EN	EN	CAN	01907			WEATHER CONDITIONS
쥐			RECOVERED	토	FIELD	FIXED	HNU SCAN (PPM)	<u>Б</u> ш	FE		PARTLY CLOUDY, MID 405, LOMPH WIND
SA		181		80	SA	SA	F E	38	PEP		SURFACE ELEVATION
									Ц	88	COMMENTS
		0		١, ١	ι	1	,		Ц,		Aspitace @ Surface
١		10	•	·					Ц		
-	4								12	0	FILL 0-6.5, SAND, WELL SOLVED.
ł	:								H	1 1	MED. TO COARSE GRAINED
.									H3	0,	
	2	İ					ŀ	sw	H	' ,	
1 2	BATCHE					8 A			H	1,0	
3	1	า				SellogA	-5cc		4		
1	ا ب	Э	25	රිකර	١,	- SE			5		
	3			ශ්	'	3			W		
١						- <u>-</u> 13					•
		ے	[* · · · ·]) 147		3	- i 50c			녈	65-10 SANOY CLAY : BROWN -1 -
-							>500	20			GREY-MOTTLES, MOIST, HYDRO CANOON
-	ı	:		2	·			SC	l a		CHOIL BEGINGT SANOTER - 1-DEPOTH
	ストなみをい			9	3			130		-:	
1	ΓŽ	0.0	S	Freeing	۱ ا	١.	750	0	1	, -	-
	. 6								-1		
	262 28	מן	S	1		'			N -	.	

FI	EL	.D	LC)G	0		<u> 30</u>	RI	N(G (CONT'D.) SHEET 2 OF 2
SAMPLER	FEET DRIVEN	FEET RECOVERED	SAMPLE	FIELD LAB. SAMPLE NO.	FIXED LAB. SAMPLE NO.	HNUSCAN (PPM)	LITHOLOGIC CODE	DEPTH (FEET)		PROJECT FAKEN JOB NO. 3K98 BORING NO. TW EH SEOS EITWILD
						ISO	S W			10-11', SAND: MEDINA GRAINED, WET, APPEAR & TO CENTAIN FREE PRODUCT
20117	S.o	5.0	FXCELLENA	i	F11-54-581108B	Soc	Cit Cit	1 2 1 3 1 4 1 5 1 6 1 7 1 6 7		11'-Di' CLAY, brown of grey mottler, hard, plastic
SPUT	5.0	ν.ς	Exce LI BANT	•	E11 - Su- 5B110B C	6 50	CL	18 19 20 21		21-TO CLAY grey hard, plastic, WET @ 21.
Fig	8.0	1	1	1	1	1		23 24 25 26	111111	SOME SAND ZONES PROBABLE BASED ON DAILLERS COMMENTS.
118	8.0	,	,	1	١	(26	=	



FIE			ما	G	OF	: 8	Ю	RII	NG	SHEET LOF 2
PLA	N —									PROJECT BORING NO.
				!	ડ કિ	PET	75		•	EAKERL AFB EITWILD9
			1	(1		-	JOB NO. 3K-98 LOGGED BY: UCE
							}'			PROJ. MGR. GUG EDITED BY: BFM
				Lpa			1			DRILLING COMPANY: A.W POOL
		. ~ 6 (2	01	ددرع م	٥,٤٥		Ent	~1100	DRILL RIG TYPE: B-Blank G1
(-11	TWI	1000	ט	-						DRILLING METHOD: Howen soon Angen
							;			DRILLERS NAME: V. BARRAZZO.
										TOTAL DEPTH (FT.) 25
										TIME 0925 DATE 12/14/91
										TIME D955 DATE 12/14/11
				DRATORY IMBER	RY					GROUND-WATER CONDITION AT COMPLETION OF DRILLING
					NE RO					saturated at 1 10 and ± 21.5
		٥		SS	OR/		ರ			BACKFILLED, DATE
2		ERE		E A B	AB N	CAN	70010	_		WEATHER CONDITIONS
SAMPLER	VEN	μŞ	SAMPLE	عو	민	ŠΞ	로벌	F H		CLEAR, LIPPER 305 , 10 MPH WIND
SAN	FEE	FEE	SACO	FIEL	SAN	HNU S((PPM)	LITHOI CODE	DEP (FEE		SURFACE ELEVATION
									茶	COMMENTS
								\prod_{i}	·	Aspitalt @ Surface
1-	2.0	-	-	-	-	-		\prod'	FM	
8										0-4.5 Fil, MOSTLY MEDIUM
	-						کن√		٠.	GARINED SAND, WEB SOMED
!							'	1 3	٠.	
] :	
					9.4	2000		N.	, .	
					54-Tw1109A			Ш.		4.5-6.0' CLAY, DARK BROWNISH GREY,
	5.6	3.5	6000	_	13		CL	115		MODERATELY SOFT, SUCHLEY PLASTIC
S.B	-		G		1 3	2500	СН			TRANSITION INTO LOWER BROWN CLAY
					2	1		16	==	SANDY
•					EI-					6.0- 9.5' CLAY, REDDING BACON,
- F		i, .	-	/		5500	50			GREY MOTTLES SOME SILT.
	\dagger	·			W W			Ц		.78
. : =		:-			601			8	1	
			Ω		Su-T-1109	>50 O:	١		. 7	NEO 1
S. F	5.0	4.0	8000	-	"			.	· ·	9.5-10.5' SAND FINE GRAINED GREY;
			"		1 1			I	1-	WET FREE PRODUCT APPEARS TO
					Ī	7500	PSW	U,	, :	B€ PREJENT.

The second second

	FIE	ΞL	D)G	0	F	<u> 30</u>	RI	N(G (CONT'D.) SHEET OF
•	SAMPLER TYPE	FEET DRIVEN	FEET RECOVERED		FIELD LAB. SAMPLE NO.	FIXED LAB. SAMPLE NO.	HNUSCAN (PPM)	LITHOLOGIC	DEPTH (FEET)		PROJECT BORING NO. JOB NO. 3K98 EII TW1109
							5c v		11	1 - 1	MODERATED PLASTIC, ABUNDANT FERCY
<u></u>	S.B.	5.0	5.0	ERCEUENT		1	i &	CH	13 4 15 16 7	-	CONCRETIONS, MINOR SILT; MOIST. -TRANSITION INTO LOWER UNIT 15-19.5 CLAY, GREY MOOFRATELY PLASTIC. MINOR SILT; DAMP. SUGHTLY MOIST
-	S.B	5.0	5.0	CRCELLENT	_	E11-54-721109C	0		18		19.5-25? SILTY CLAY, GREYNISOME LT. BAN LAMINAE, SCFT. WATER NOTED @ ~ 21.5'
	BIT	-	-	_	-	-	-		- 3-3 - 3-4 ->-5		TD = 25'
										2	
										2	



FIE		וכ	_0	G	OF	3	O	RII	NG	SHEET OF
PLAN										IPROJECT BORING NO.
		- 1		S	HOP6	ETT	E		l	EAKER AFB EHTWHO 155 5/31/92
		l								JOB NO. 3 K9 & LOGGED BY: UNE
		İ			!				l	PROJ. MGR. GUC EDITED BY: BFN
.]		1	<u> </u>	ben: 6		@ <u>F</u>	EIIT	WIC	,	DRILLING COMPANY: A.W POOL
		İ	ر ۹۸	200	つ					DRILL RIG TYPE: B-61
		,		ENSE		9 (Eliti	woq		DRILLING METHOD: Houses STEM AUGER
		. \								DRILLERS NAME: V. BARRAZZA.
			VAC	was	-\					TOTAL DEPTH (FT.) 25
					'					TIME 322 DATE 2/14/91
									7	TIME COMPLETED 135.5 DATE 12/14/91
		i		٠,	≿					GROUND-WATER CONDITION AT COMPLETION OF DRILLING
				ERY	TORY					SATURATED I 8.5
		٥		BORAT	SE SE		ပ			BACKFILLED, DATE
E		2		ØZ V	SA S	CAN	01907	_		WEATHER CONDITIONS
주 의 교	KEN	FEET RECOVERED		크루	ם	OS (W	LITHOL CODE	FT		CLEAR, MID 405, 10 MPH WIND
SAMI	FR	品高	SAMPL	SA	SEX	HNN (100	35	.a	SURFACE ELEVATION
									1 01	COMMENTS
								\Box .	١	ASPITALT @ SURFACE
Bit	2.0	-	-	_	-	-		□′	o FM	
									e TV	0-25 Fu (NOT RECOVERED)
									!!	
	İ				7	100	SC	- N _	-:	2.5-4.5, SANDY CLAY DARK BROWN,
İ					શ					ORBANIC ACID
					₹ 0					
					01:134	>500			\$ s.	- TRANSITION W/ LOWER WIT
S.B.	5.0	4.5			13	7500			-:-	4.5 - 8.5' SANDY CLAY TO CLAYET'SAND,
			0	1	1 4			5	<u></u>	Brown of GREY MOTTLES, MOD. SOFT,
			ુ		1 0				-	Damp.
					1 -			II.		
						7500		4		
-	+-	+-			্র্টেড			N		
-			-		- TO	100				
					1110			8		
SB	5.	93.5	5		13	300	•	t		8.5 - 9.5
					5		50	_ 9		8.595 Tre CLAYEY SAND BROWN W/
1	1				1	20		啊 一	4.	GREY MOTTURS MOD TO FINE GRAINED

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FII	ΞL	D	LC)G	01		<u> 30</u>	R	<u>IN</u>	G (CONT'D.) SHEET ZOF Z
SAMPLER TYPE	FEET DRIVEN	FEET RECOVERED	SAMPLE	FIELD LAB. SAMPLE NO.	FIXED LAB. SAMPLE NO.	HNUSCAN (PPM)	LITHOLOGIC CODE	DEPTH (FFFT)		PROJECT BORING NO. EAKER AFB JOB NO. 3K98 EII TWILLO
								1,	/-	85'95' (CONTINUED) WEE IN SAND PONE.
S.B	5.0	5.0	Excenent	•		0	CH CH	12 13 14 16		95'-13' CLAY HARD, PLAINE, BROWN MGREY MOTTLES MINOR SILV, FE STRING and Addules. DAMP. -TRANSITION ZONE WY GREY CLAY BELOW 13'-22' CLAY GREY, HARD PLASTIC, SOME RED STAINS, MINGRISHET
S.B.	5.c	5.0	CYCELLENT		1	0		16 15 14 14 14 15 16	7	22-25' BIT (NO RECOSENES)
BIT	1	_	_	_	_	_) - - - -	-	
									5 5 8 9 0 1	70=25'sm
NO.	TES:								4 5 6 7 8 9	



	U L		j Ul		KOF	<u> </u>	<u>UV</u>	SHEET / OF 2
PLAN			N					PROJECT BORING NO. EAKER AFB EIITWIII
		· · · · · · · · · · · · · · · · · · ·						JOB NO. 3K98 LOGGED BY: BF N PROJ. MGR. GVG EDITED BY: BF N BF N BF N
								DRILLING COMPANY: Pool
44.0	,	Promas				1	4	DRILL RIG TYPE: mobile, 861
							Str	DRILLING METHOD: 644 Hollow Sten Auens
January VIII		(2)				,	>	DRILLERS NAME: V. Bu-Mazza
G.	الراق الراق	\$1	pulles.				ا ي	TOTAL DEPTH (FT.) 221
armin				,				TIME STARTED 6753 DATE 12.15.91
								TIME DATE DATE 12-15-5/
		TORY	ER FR					GROUND-WATER CONDITION AT COMPLETION OF DRILLING Entumbed at ± 110 and at ± 211
	a	19			ပ္			BACKFILLED, DATE
SAMPLER TYPE FEET DRIVEN	VERE	SAMPLE CONDITION FIFT DI ABOR	LE NUI		THOLOGIC ODE	ΞC		WEATHER CONDITIONS Cleur, coid, listbreaze & 30°F
	E S E	MAN	SAMPI	HNU S(LITHC CODE	DEPTH FEET		SURFACE
35 65	正定	<u> जठाव</u>	S IE	TE	70	우리		COMMENTS
		,				4 [CANO.	
1		1	1 1			-1 /		Asphall at surface 0.0-0.3
2	0						v1 6	Fill; cravel mixed al fine s
						Llo 1		1,11 673861 111,166 111
:						2		a.3.1.0'
					<ı./			a.3-1.0'
V.					SW			Fill: Sand, branche stay branch
4				> 50ij	JW			Fill: Sand, beauto completed medium to course vained, loose
BAKEN				> 50ú	JW			Fill: Sand, branche stay branch
F BAKE			1-1		7 4 7 86			Fill: Sand, bear to startions
AKE	,	Y	1-111-1	> 50ú	7 4 7 86			Fill: Sand bound to grayboars medium to course rained loose 1.0 to 7.0
Spell BARKE	, re	OOOR	1111-1111-1		7 4 7 86			Fill: Sand, bear to stantians median to course stained loose
F BAKE	, 4	Pook	C1174-111-1		7 4 7 86			Fill: Sand bound to grayboars medium to course rained loose 1.0 to 7.0
Spert BARKE	, rs	Pook	C1170-111-1		7 4 7 86			Till: Sand bound to standing of medium to course sained losse 1.0 to 7.0 Clay brown, with silt and Unce of Sand moist, soft
51 50615 BARKE	4	pook	1-111-n11-1		7 Taris Sea		こうから かんしょうかん かんしょう かんしき	Till: Sand bound to standing of medium to course rained loose 1.0 to 7.0 Clay brown, with silt and Unce of Sand moist, soft
51 SOLIT BARKE	76	POOR	1.5	7500	Traising States		これのは、このからないのはないのでは、これのでは、一大は一大のでは、	Fill: Sand brown to stay boxen medium to course rained loose 1.0 to 7.0 Clay brown, with silt and trace of sand moist, soft for medium stiff, Survey zone xill Surly zone al clay movery
51 SOLIT BARKE		POOR	1111. Z		Traising States		これのは、このからないのかないからないとうない 一年十二十二十二十二十二十二十二十二十二十二十二十二十二十二十二十二十二十二十二	Fill: Sand, brown to crayboan medium to course rained, loose 1.0 to 7.0 Clay, brown, with silt and Uses of sand moist, sast to medium stiff, promise, sast

	FII	EL	D	LC)G	O	FI	BC	RI	N(G (CONT'D.)	SHEET < OF <
•	SAMPLER TYPE		SVERED	IPLE DITION	FIELD LAB. SAMPLE NO.	FIXED LAB. SAMPLE NO.	JSCAN M)	40LOGIC		•	PROJECT ENKEL NEB JOB NO. 3K9E	BORING NO.
							600	CL	2	1-1-1-1	me mittled zene	e, yery moist, melian
	Tilds. 2	۶,	ts.	8000	1	1	600 600		5	4777	Clay ber son	, noist very stist
	5 3011.7	ک ,	, ۍ	مي ش مي	1	1	600	CH	8 9 20		plastic some 16-22' Suturated 21.00	silt present modified
									3 4			
									7			
										2		
	NO.	res:							H &			
	110		-									



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F	ΙE	<u>L</u> [וכ	_0	G	OF	: 8	01	RII	NG	SHEET OF Z_
	AN										PROJECT BORING NO.
٦		•					 				EAKER AFB EITWILZ
11	5		7								JOB NO. 3 K98 LOGGED BY: BFN
		þ								. !	PROJ. MGR. GV G EDITED BY: VSB
	13%	E	6	AHOI	94 45 5 e S	7					DRILLING COMPANY: Pool
	-		1			_				ļ	DRILL RIG TYPE: MOBILE, 861
			,	4	914 1	1112					DRILLING METHOD: 6 y Hollow sten Augus
	(2516							DRILLERS NAME: V. Barrazza
	وتعملا	48111									TOTAL DEPTH (FT.) 25
	6	V								İ	TIME DATE 12-15-9
'											TIME COMPLETED 1030 DATE
	Ī	Ī	i		>	> 1	1				
					55	TORY					COMPLETION OF DRILLING SATURAGE ZET ES # 8-5 JUL 5 and #2/
					S B I	A B		, ,			BACKFILLED. DATE 12 16 8 /
\ ~	.		36	N N	요로	LE NUME	Z	,0GIC		!	WEATHER CONDITIONS
ü	ш	z	VE	빌	75	FIXED LABOR SAMPLE NUM	SC P	2	FF		clear, ead, lisht breeze 2300
N N	YPE	⊒Ž	FO	MN	38	ME S	HNU S((PPM)	LITHOL CODE	FE		SURFACE
3	1		E.E.	30	正公	正分	로	<u> </u>	温品	1	ELEVATION
	1					İ			Ц		Π΄΄
-			•						Ц,	20.0	Asphalt at surface 0-0-0.3
3/	1817	_	0	1	1				Ц	-	
18	\$	2								FM	Fill: Gravel clust mixed ulfins
-										Lin	0.3-1.0
	į								3		
İ							75000				Sandy Clay , aret I some sitt
							ľ		Π.	-	moist soft true prearies
l	'n.						ا ا	ļ	T*	-	(court hours) possible fill
İ	BAEKE						750,5	CL	П	_	store hidocaches adar.
- 1	\$				١.		1	Sc	- 5	-	
1	1	,		100	/	11	3.5		H	-	
	5 7617	4	3	100	1	1	3,4		46]-:	Sand seam & 8' 108.5', suteroke
	. ,5					<u> </u>] 1		H	 	38.88 38.88 2 11.0
}-			10000					-	7	<u>ਬ</u> 	Sund Scam 2 10 to 10.5' butuned
- 1	×				- RAM				#	#:	3000 0000
	PAKKE						3500		He	-	
	110							Sin	Ή		Clay content begin to increase
						1	7500	U	 		below 10.5'
	38417	1	1 4					5	şЦ_	'	
	انم	1		`		1	1	أكأ	<u>-</u> ∐,	ـــا	

L	D	L()G	O		<u> </u>	K	N	(CONT D.) SHEET ZOF Z
DRIVEN	FEET RECOVERED	SAMPLE	FIELD LAB. SAMPLE NO.	FIXED LAB. SAMPLE NO.	HNUSCAN (PPM)	L/THOLOGIC CODE	DEPTH (FEET)		PROJECT EAKEL AFB JOB NO. 3K98 EIITUIIIZ
					7500				
6	4	Euow.	1	1	;0 0	C'H	13 14 15 16		Clay brownish stay, slightly mottled, moist medicastiff some silt trace of sont, plustic 10.5-15.0
5	\$>	pins	1	1	0 0	<u>دا</u> د	- 1 9 - 20 - 21	7	Clay, blue stuy, moint, stiff
5 Arn	ilc el	in St	2.5	•			23		
							11 .	1	T0=25'
								2	
	DRIVEN	DRIVEN FEET FEET RECOVERED	DRIVEN S. 5 DRIVEN FEET RECOVERED SAMPLE SOUN CONDITION	DRIVEN PROVERED PROVERED PROVERED PROVERED PROVERED PROVING	PEET FEET FEET FEET FEET FEET FEET FEET	DRIVEN THE T RECOVERD THE T RECOVERD THE T RECOVERD THE T RECOVERD THE T CONDITION THE T CONDITION THE T CONDITION THE T CONDITION THE T SAMPLE NO. SAMPLE	DRIVEN THE TOTAL STATE	DRIVEN FEET FEET BANDLE CONDITION FIELD LAB. SAMPLE NO. FIELD LAB. SAMPLE NO. FIELD LAB. SAMPLE NO. FIELD LAB. SAMPLE NO. FIELD LAB. SAMPLE NO. FIELD LAB. SAMPLE NO. FIELD LAB. SAMPLE NO. FIELD LAB. SAMPLE NO. FIELD LAB. SAMPLE NO. FIELD LAB. SAMPLE NO. FIELD LAB. SAMPLE NO. FIELD LAB. FIELD LAB. SAMPLE NO. FIELD LAB. FIE	DRIVER CONDITION OF THE TABLE O

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FIE		ו כ	٥	G	OF	. B	O F	711	NG	SHEET 1 OF 2
PLA	N									PROJECT BORING NO.
			इम	SY OF PET		Nois				FAKER AFB EILTWILLS
٦.			_				ر			JOB NO. 31498 LOGGED BY: LIFE
U :	:									PROJ. MGR. GUG EDITED BY: BFN
43	ĺ	,			DIAN			-7		DRILLING COMPANY: AW POOL
0	•	(ME	DIAN			7)	_	DRILL RIG TYPE: 8-61
						_	11 TW	· /	' •	DRILLING METHOD: HOLLOWSTEM AUGEN
				~@(EII TW		5 CS			DRILLERS NAME: U. BAYLARIZA.
1	GRAS	s		*. /.	~70'	4	*	4	Ì	TOTAL DEPTH (FT.) 27
	•	-+		۱ مارد	\ <u>\</u>	EIIT	~(II)	3	٧	STARTED 1350 DATE 12/15/91
		4		···			4			TIME COMPLETED 1445 DATE 12-115/91
				LABORATORY E NUMBER	ERAY				·	GROUND-WATER CONDITION AT COMPLETION OF DRILLING Saturated zones at a roll and to 2.
				A B	MAR		ပ			BACKFILLED, 0739 DATE 12-18-91
ER		ERED	ACI TON TON	ØZ.	Y Z	CAN	HOLOGIC DE			WEATHER CONDITIONS
무미	FEET DRIVEN	S-	핕	급	25	SS	<u> </u>	TI.		CLEAR SMPIR WIND, MIDYOS
Y D	E SE	HOE	AO N	AE	FIXED	PPM	CODE	DEP (FEE		SURFACE
Ø1−	40	<u> </u>	80	r co	II O	<u> </u>	טב		1 10 10-	COMMENTS
								H		GRASS @ SURFACE
1	0	1	1		ŀ	١	ML	4	NP	OPAIS C SHOPAGE
8	9			,			·	H		
+							e . 1	2		0'-3' PLOW ZONE & POSSIBLY FILL.
						D	SW.		• • •	2-3 MED. TO COARGE BRAINED
· i 、								3	1-1-	SAND, DAMP, SOME BLACK GEGANICI
1 5							CL			AND RED TRON CONCRETIONS
BA PUPE U										3'-4.5' SILTY CLAY, D'ARK BROWN
\ \ <u>\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \</u>		0	0	j	1	٥		M] - <u>-</u>	VIENT MOIST SOFF, MOD PLASTIC
	S	Ŋ	Good	'				5	= -	4.5-10' SILTY SANDY CLAY, LT REOWN
SPS	<u> </u>		9		1				-:	W/ RED + GREY MOTTLES,
1	5									BECOMES LIGHTER IN COLOR MDEPTH,
			-		<u> </u>	0			: <u>-</u> -	MORE GREYNI DEPTH.
	1		 		-			F		ZONES HAVE WATER IN 8-10' DUTENUES.
- ا						0	-		:-	SANDY DUTTINALS ARE 1-6" THICK.
BANNEL	0	0								
		N.	0]			M	-	
SPAF	"		Gooct		'		CL	M ⁹		
19.	1		w			0	ML	-т-	-	
1 5	l	ı	ı	1	ı	i	1	4 10) · ~	

FI	ΞL	D	LC	G	O	= [30	RI	NO	G (CONT'D.) SHEET 2 OF 2
LER	FEET DRIVEN	SVERED	MPLE	LD LAB. MPLE NO.	XED LAB. MAPLE NO.	Z	LITHOLOGIC CODE			PROJECT BORING NO. EALER AFB JOB NO. 3K98 EILTWILL3
\displays	r ne			PIE SAI	FR	0	0	1/		10'- 21' CLAY, LT BROWN TO GREY. SILTY; RED IMM STAINS 12'-21'.
S.S.	5.0	5.0	CRCELLENT	•	1	0	CH	13 14 15 16	- - -	- BECOMES GREYER + LESS SILTY IN 12-19.5 DUTTERWAL, PLASTIC, HARD -19.5 - 21', BECOMES LT BROWNISH
S.B	5.0	5.c	F	E1113-01 633'	ł	0 2 7	_	17 18 13 24 2-1		RED, LESS PLASTIC, MODE SILTY THAN ASONE 21-27 SAND, COARTE GRAINED MOD. WELL SORTED, WET.
				Tu			- 9~	H		22'-27 is some (as per drillers connects TD =27'
NC	TES								5 6 7 8 9	



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FIE) [_0	G	OF	B	OF	RIN	1G	SHEET 1 OF 2
PLAI										PROJECT BORING NO.
	1-1-1	773		_			7		-	EAKEL AFB EII TWII14
1 1	C 12	115	10	€ 1	111	1 !		11		JOBNO. 3K90 LOGGED BY: URE
										PROJ. MGR. GVG EDITED BY: BFN
	,	DEI	i Twi	1114				ARLEN		DRILLING COMPANY: A.W POOL
	,	שני	((**			√ ©	ELIT	اااال		DRILL RIG TYPE: 8-61
	spa	. .				`				DRILLING METHOD: HOLLOW STEM ALGER
`	ろうへ					\				DRILLERS NAME: V. BARMAZA
					-	٠				TOTAL DEPTH (FT.) 24'
					1.	•				STARTED 6955 DATE 12/16/91
					1	•				COMPLETED 1105 DATE 12/16/91
				TORY ER	RATORY MBER					GROUND-WATER CONDITION AT COMPLETION OF DRILLING Saturated zone at t 8 and t 21
		_		RAT	RAT					BACKFILLED, DATE
~		FEET RECOVERED	N N	LABOR.	MN	Z	LITHOLOGIC CODE			WEATHER CONDITIONS
E E	Z	VE	ÄË	S.E.	25) SC/	<u>0</u>	EE	•	CLEAR, MID 305, 5 MPH WIND
SAMPLER TYPE	FEET DRIVEN		SAMPLE CONDITION	FIELD 1 SAMPL	FIXED LA SAMPLE	HNU SCAN (PPM)	HO	DEPTH (FEET		SURFACE
18	EÖ	uα	တပ	FS	FR	IS	0	10-	-	COMMENTS
								Н		GRASS @ SURFACE
Bit	2.0	_	_		_	_		H′	1	0-4' No necevery
								H		
			\vdash					12		
								H_{-}	İ	
								3		
								Π .		
Ì						0	Siv			. 4.8-S.O SAND MED GLAINED MOIST.
5.8]	۵				 		÷ •.	
و.د	5.0	3.0	0000	1	1,	C				5-6' Sivry CLAY DARK BROWN, MOD.
				'	'		CH		_	SOFT, SUGATION PLASTIC MOIST.
							CH			MINON SAND
*	. 3.4					U		3,		6-13 SANDY SILTY CLAY BROWN
	+-									of Bary MOTTLES. SUGGETY
							Ci	1 8	, -	PLASTIC, MISSE TROW STAPUS
				į ,	,				-	12'-13'.
		c 4.9	. 4		11				$,ig _{-}^{-}$	WET ZONE 8'-10' IN MORE
۶.٩	, ン・'	7 70.7	5	2		٥				SANDY BUYER INTERVALS
			ú	آر					ا ام	

	<u>ر سا</u>	<u>ر</u> ر	<u>U</u>		<u> </u>	1 \ 1	14/	SHEET - OF 2
FEET RECOVERED	SAMPLE	FIELD LAB. SAMPLE NO.	FIXED LAB. SAMPLE NO.	-	LITHOLOGIC CODE	DEPTH (FEET)		PROJECT EAKER AFA JOB NO. 3K98 EII TWILL
				υ		1/	1	-TRANSITION W/ LOWER GREY UNTI @ 13'
5.0	ERCELLENF	1	•	0	CH	13		13-21' CLAY, GREY, HARD, PLAITIC, PEO TROWSTAINS 13'-16'. -BECOMES HANDER + MONE PLASTIC W DEPTH.
	ERCEUENF	1-61119	•	0 0	SW	18	2012	21-24 SAND, COARSE GRAINED; WET;
-	-	-	-			5		MET @ ~ 24' TD = 2-4
						B		
						3 4 5		
¥			- 110-			8 9	-	
	5.0	FEET SOUNDITION FEET SAMPLE SAMPLE CONDITI	FEET RECOVE RECOVE RECOVE RECOVE SAMPLI RELDI RECOVE SAMPLE SAMPLE SAMPLE	FEET RECOVE RECOVE RECOVE RECOVE SAMPLE RECOVE SAMPLE RECOVE SAMPLE RECOVE SAMPLE SAMPLE SAMPLE SAMPLE	FEET SAMPLE ONDITI	FEET RECOVE RECOVE RECOVE RECOVE RECOVE SAMPLE	FEET ON THE PROPERTY OF THE PR	FEET

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TE		ב ז כ	٥	G	OF	. B	OF	RI 1	NG	SHEET 1 OF 2
LAI										PROJECT BORING NO.
	•			(3			PARKI		EAKER AFB ENTWINS JOB NO. 31498 LOGGED BY: JUL
								of B×		PROJ. MGR. GVG EDITED BY: 3FN
-							!	Silvere	TTE	DRILLING COMPANY: A.W. POOL
				EUT		_				DRILL RIG TYPE: 8-61
		_		FILT	√i (۱\;	3	· -			DRILLING METHOD: Howow STEM AUGER
		GRA	دی							DRILLERS NAME: V. BARRAZA .
					TWIII	15				TOTAL DEPTH (FT.) 22'
				0)		1	1		TIME 1320 DATE 2/16/91
			THA	772 O	LEET	·-		ש) ע		TIME COMPLETED 1420 DATE 12/16/91
					FIGHT					GROUND-WATER CONDITION AT COMPLETION OF DRILLING Saturated Zones at + 7 and 17'
				NA BI	MB		၁			BACKFILLED, DATE
٤		RE	<u>S</u>	AZ Z	83 83	CAN	00			WEATHER CONDITIONS
SAMPLER	ET	EET ECOVE	SAMPLE	APP.	FIXED L SAMPL	HNU SC (PPM)	LITHOLOGIC CODE	EPTH FEET		CLEAR, MID to UPPER 4CS, WOUTHIND
ñ⊢	E D	TR	SO	E S	E S	E	70			COMMENTS
								H		GRAN C SURFACE
317	2.0	_	_	_	_	-	'	H′		0-2 NO RECEIVENCY
		}						H		0 2 100 1000
				, — —		0	CL	2	1.1	2-3' CLAY DAME BROWN ORGANIC
	: :								- <u>'</u>	RICH, ABUNDANT ROOT HAIRS. MOIST
							141	3	-	3-9' CLAYEY SMOY SILT/SILTY JANDY
							MLCL		1_:	CLAY : BROWN . SILTY ZONES . MONT
_			4			0			5	ARE MORE FURBLE THAN CLAYES ZONES.
SB	5,0	5.0	4							ROOT HAIRS + OROMANCE COP. MOIST
			F KCELLEN	-	-			5		
			K					6	_	
			W			0			-	
				-	#		. 21.2			
		1.	1		1	0	+		-	- WET ZONE ~ 7 WHERE MORE SAND
-	-		وا ا	α	,	a ~ : * : *	 		-	IN PRESENT
				g G	·					
2.	3 5.	0 50	ı l	1	- -	0	CL	9	1	-
			ני ני	- L	?		CH		-	9-19' CLAY, BICOWNISH GREY WIRED
	Ì		U	םו וי		1		H	-	MOTTLES HORD PLASTIC. MINOR SD + SI

	FIE	ΞL	D	LC)G	01	F	30	RI	N(G (CONT'D.) SHEET 2 OF 2
,	œ	z	VERED	SAMPLE	FIELD LAB. SAMPLE NO.	FIXED LAB. SAMPLE NO.	Z	10L0GIC	DEPTH (FEET)		PROJECT EAKER AFB JOB NO. 3198 EIITWIIIS
			pr	6J -	PAGG				()	1	- Drow STAIRS 11-12
. ·	S.8,	5.0	510	Steelle. S			0		12 13 14 15 16		
	S.B.	5.0	5.0	Cree/es &	E1115-2 30'		0	Sc	16 15 20 21 21	V	19-22 CLAYEY SAND, LAMINATED, SANDFINE GRAIN - SAMPLE SATURANED @ 19.5', VERY MOIST TO WET UP TO 17', GREYISH BROWN */ REDOISH LAMINAE
										5 5 7 9	1-6-6 = OT
-		TES	75.				-			8 <u>-</u> 9	



~ **4***

FIE		וכ	LO	G	OF	. B	OF	711	NG	SHEET OF 2
PLAI					1	i				PROJECT BORING NO.
1	5 (bor	PETE								EAKER AFB EIITWIII6
	7 1001	1	•							JOBNO. 3K-98 LOGGED BY: JM
			ረ ትላኝ ጋ				En	wil	ردا	PROJ. MGR. GJG EDITED BY: BFN
		- 60	<u> </u>		15		0		_	DRILLING COMPANY: A.W. POOL
	L	1 killi			٥					DRILL RIG TYPE: 8-61
ļ					378					DRILLING METHOD: 1000 W STEM AUGEN
										DRILLERS NAME: V. BARRAZA
				•						TOTAL DEPTH (FT.)
					\		\			TIME STARTED 1530 DATE 12/16/91
						_				COMPLETED 1428/600 DATE 12/16/91
				RY	RY					GROUND-WATER CONDITION AT
				ATO BER	ATO SER					SATULATED ZONE ! 10 and 1
		g	_	LABORATORY E NUMBER	ABORATORY E NUMBER	_	2			BACKFILLED, DATE
E	7	ERE	m _E	EN	ABA	CAN	Ö			WEATHER CONDITIONS
SAMPLER	FEET DRIVEN	FEET RECOVERED	SAMPLE	FIELD L. SAMPLE	FIXED L SAMPL	HNU SCAN (PPM)	LITHOLOGIC CODE	DEPTH (FEET)		CLEAR MID 505, UGHT WIND
SA	AR OR	E E	800	RAS	E A	至	58	<u>B</u> E		SURFACE ELEVATION
			İ					Ц		COMMENTS
	ت و				_	_		Ц,		GRASS @ SURFACE
815	Q.C	_	-	~			ļ	Ц		0-25' No RECOVERY
								2		
						0			-:-	25-6 SILTY CLAY, BROWN WY RED MOTTLES
		ļ	7					3	= -	25-6 SILTY CLAY, BROWN WILLED MAITCE!
									=	
							CL	4		- A
CR	5.0	J d S			1,		1	1	-	- Moist Hole '
3.5		1.5	। হ	<u>`</u>		0		5		
			5		'					6-10.5 CLAYEY SANDY SILT, BREWN W/
								6	1 - 1	REDOISH MATTLES, VERY MOIST.
		100.0				. 0	ML		-	- WET IN ZONES WY CESS CLAY LAMINAE.
-	+		.4.67.	V. m²				7	<u> </u> !	
1	-			0.0	7	0			<u>0.1</u>	
				1-5.	- .			8	1	SATURATED IN CORE BARREL @ "B" IN 6"ZONETHAT
5.1	g 5.	0 H 2	ع ا	$2 \int_{0}^{\pi}$				وا		LESS CLAYEY.
		7,0	3		<u> </u>	0			1::	<u> </u>
)	11	<u> </u>	-	-		-	

OG OF BORING (CONT'D.) SHEET ZOF Z BORING NO. PROJECT LITHOLOGIC CODE SAMPLER
TYPE
FEET
DRIVEN
FEET
RECOVERED
SAMPLE
CONDITION
FIELD LAB.
SAMPLE NO
FIXED LAB.
SAMPLE NO
HNUSCAN
(PPM) FAKER AFB EIITW1116 JOB NO. 3K98 Brownsh 10.5-12.5, SILTY CLAY GREY W REPORT MOTTLES. MODERATELY HAM PLASTIC CL NEWS WOIL Grey 0 CLAY. 7210M , F702.00M PLASTIC. SOME SILTY ZONES. S.B. S.0 5.0 15 0 - REDDISH HEMATITE/ LUMONITE 16 @ 14-16' Ó - 17-19' WET MORE SILTY THAN 0 DRIEK ZONEL ABOVE + BELOW, HE SB 5.0 5.0 0 - SMALL HEMATITE STAINS 18.5-201 0 22 Tn = 22 NOTES:

* WATER ON COME BACKER (3 2)





OF BORING SHEET____ BORING NO. **PROJECT** PLAN EAKER AFB EUTW1117 THI IST LRE JOB NO. 3149 B LOGGED BY: EDITED BY: PROJ. MGR. GVG Bx BFN Θ DRILLING COMPANY: AW POOL EIITWIII7 4 PER POSICE BE / DRILL RIG TYPE: Ha-LOW THED DRILLING METHOD: HOLLOW STEM AUGER PALLENG LOF BARRAZA DRILLERS NAME: V٠ 12 TOTAL DEPTH (FT.) DATE TIME 0815 12/1/1 91 STARTED DATE TIME 12/17/91 COMPLETED 0826 GROUND-WATER CONDITION AT COMPLETION OF DRILLING SAFER ZONE At \$ 85' FIELD LABORATORY SAWPLE NUMBER FIXED LABORATORN SAMPLE NUMBER BACKFILLED, TIME DATE SAMPLER
TYPE
FEET
DRIVEN
FEET
RECOVERED CODE CODE 622 SAMIPLE HNU SCAN (PPM) WEATHER CONDITIONS DEPTH (FEET) CURAR, MID 30s, 5 MgH WIND SURFACE ELEVATION COMMENTS ASPHALT @ SWEFACE **t** . ſ 9 **8** 7 ત્ 0-3.5' NO RECOVERN L 0 3.5-5.0' CLAYEN SILT, DARK BROWN BALLER 11134 Orbanic Horizon, Dry رېمورې ML 0 \(\mathcal{V}\) 7 ñ 5.0- 9.5 SILTY CLAY REDDISH BROWN Û 7 5 WHAREN MOTTLES BECOMES GREYER Č M DEPTH. MOIST TO WET. E WET IN MORE SILTY HORIZON' (SEE BEI ٥ J Show C DOOR DOOR CL 9 BARGE B 8 - 8.5to 9.5 WET FREE WATER C VISIBLE IN TWO 4" ZONES Q かとい しとから Ŋ Ś 0 9.5-12 GREY WILT BOW MOTTLES 5 SLUTY; SOME REDDISH-BLACK STAINS (FOZ) PLASTIC, MOD. HARD MOIST



,	FIE		D I		G	OF	: E	30	RII	NG	SHEET OF
	PLA	N		1:1	1	:	ًا أحد	1		!	PROJECT BORING NO.
		ļ			:	NN O				!	EARER AFB EITWILLS (ABANDONER
					ľ		1170011	0	0	BX	JOB NO. 3K98 LOGGED BY: UNE
		01	SPE	SEA	Š	- 6	-117 0-11	E	וווישדוו	7	PROJ. MGR. GVG EDITED BY: 6FN
			L	1	8		Ĭ	EIITE	9		DRILLING COMPANY: A.W. POOL
		,	STITEE,	(,,,		~30′			ر6€ د محا	`	DRILL RIG TYPE: Howard French hugen
		1	F	1.	\		1		3		DRILLING METHOD: Itallow stem Access
			, 3	\setminus	<i>:\</i>			EIIT	۱۱۱۳		DRILLERS NAME: V. BARRAZA
			1 3	į \'	$\int_{-1}^{1} i$	7					TOTAL DEPTH (FT.) 12
			$\frac{1}{2}$	- \		رست.	,			- (**	STARTED 0855 DATE 12/17/91
			,		\	A K.(</td <td>fns v</td> <td>, ,</td> <td>1veh</td> <td><i>برد</i></td> <td>COMPLETED 0920 DATE 12 17 19 1</td>	fns v	, ,	1veh	<i>برد</i>	COMPLETED 0920 DATE 12 17 19 1
					ORY	RY				·	GROUND-WATER CONDITION AT COMPLETION OF DRILLING Saturated zone at 1 8.5'
			ļ		ATO	ATORY Ber					
			ED	Z	SON NO M	BOR MJ	7	<u> </u>			BACKFILLED. 16:35 DATE 12-17-91
	ER	z	/ER	비	E	A	CA	9	TC		WEATHER CONDITIONS
	AP PE	ET IVE	ET	MS	A P	FIXED LABOR SAMPLE NUM	HNU SCAN (PPM)	THOLOGIC DE	DEPT FEET		CLEAR, MID YOS, LIGHT WIND
	SA	FE DR	FE	80	SA	ES	五三	100			SURFACE ELEVATION
•									Ц	<u>~~</u>	COMMENTS
	h				_	_	_	_	Ц,		ASPITANT @ SMFACE
	BIT	J .0	0						Ц		
	-								2		2-5' SILTY CLAY, DARK BROWN
	1	!			<u> </u>		0			-,-	TO GREVISH BROWN; SUGARRY PLASTIC,
	i								3		MODERATELY HARD,
	1							CL			- Improcauson open
									4		
				l			3			-,-	
	3.B	50	5.0						5	 -	5-9.5' Sivry cray GREYER BROWN
											I RED MOTTLES SUGHTUS MOIST TO
-				1				lc L	6	_	WET.
							2				- 8.5 - 15' WET IN MERE SILTY PONES
		-	-	<u> -</u>	-	 -	<u> </u>	Ct	7	-	Two .3"4" zones HERE WHERE WATER
22000					9	<u> </u>	30	<u></u>	N _		and the second s
A PER CONTRACTOR OF THE CONTRACTOR OF THE CONTRACTOR OF THE CONTRACTOR OF THE CONTRACTOR OF THE CONTRACTOR OF THE CONTRACTOR OF THE CONTRACTOR OF THE CONTRACTOR OF THE CONTRACTOR OF THE CONTRACTOR OF THE CONTRACTOR OF T					1 6	i i			8	₹ -	
					Fila					-	9.5-12 CLAY, GREY W/ LT REPOIS WER
	Se	5.0	5.3		1:				9	-	MOTTLES, PLASTIC, MOD. HARD, MOIST
					ତ ଦ		90		11 -		
~	ı	1	1	•	1 =	; '		1	10)! 	The second secon

FI	EL	D	L)G	0	F	BC	RI	N	G (CONT'D.) SHEET -OF -
SAMPLER	Z	TOVERED	SAMPLE	FIELD LAB. SAMPLE NO.	XED LAB.	HNUSCAN (PPM)	LITHOLOGIC	DEPTH (FEET)		PROJECT EAKER AFB JOB NO. 3K98 TWILLS
St	e k	PRE	۲.	PAG	E	0		-11	- 1	12-36 CLAY, GREY: HARD, PLASTIC, ABUNDANT
S.B	5.0	5.0	EKCELLENF	l	`[0	CL	13 14 15 16 17	1,1,1,1,1	FE STAINS AND "NODINGS FOLLOWING OUT ROOT HOLES; MINOR SILT; DAMP 20' SILTY 17'-205' CLAY, BIZOWNISH GREY W ABWIDAN PED TO STAINS + "NOOMES", STUTY JAK
S.B.	Sio	¥0	EXCELLENT	E1119-02	1	0 0 0	CL	\ 8 \ 90 \ 7 / \ 02	1717171	PED TE STAINS + "NCOMES" . STUTY DIE -WET C 18' 20' - 21' 20:5/2 - 24 JAL CLAY, GREY HARD, PLASTIC, ABUNDAM TE STAINS AND "NODULES" CSAME AS 12' -17'
								3 4 5 6 7 8		TD = ZZ
								9 0 1 2 3 4 5		
NO1	TES:							6 7 8 9		

THIN IS



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F	TE			٥	G	OF	8	OF	<u> </u>	NG	SHEETOF
P	LAN									7	PROJECT BORING NO.
ĺ		•	•	ひょて	44				N.	9	EAKER AGB BX ShopeHe TW1120
	<u>ا</u>	<i>~</i>	 G	~~	 !i! 2-c	~	^_		7		JOB NO. 3K98 LOGGED BY: 15B
	1		1		11 22	•			}		PROJ. MGR. GVG EDITED BY: BFN
				ટ્ટ -					,		DRILLING COMPANY: A.W (30)
	1			Ż	0 7	-wiii	3		ζ		DRILL RIG TYPE: Mobile B-61
	م ا							(2)	}	Ì	DRILLING METHOD: Hollow stem muzer
	S C	ን _ም יי	115					0 ₇	sn4' (DRILLERS NAME: V. Barazza
1	2								}		TOTAL DEPTH (FT.) 30
											STARTED 1019 DATE 1-7-92
	1										TIME COMPLETED 11/2 DATE 1-7-92
=			T		<u></u>	≿					GROUND-WATER CONDITION AT
						ER					COMPLETION OF DRILLING SATURATED ZONE OF 29' UND 11' and 11'
				- 1	BORA	NUMBE		ပ္			BACKFILLED. TIME 1/9/12 SEE WELL COMPLETE TO CANDITIONS
	ER		ERED	01	ğZ	PZ	Z	0000			
	준 의	FEET DRIVEN	-Š	PO PO PO PO PO PO PO PO PO PO PO PO PO P	コー	FIXEDL	FPM)	LITHOL	PTH ET		wol, 450, ptly cloudy, light breen
	ZA	EE!	HE	80	SAE	SA	型		13J) 430		SURFACE ELEVATION
t										• , •	COMMENTS
ţ	ار	I								• •	GRASS AT SMAFACE
3	Auces 0'7	7	- 1	1		'	'		7′		
3772	40										DK BROWN - BROWN SILTY SAND W)
1								'		· ;	SOME CLAY, DRUANICS ARUNDANT
ن								Sing	∐ <u>.</u>	1: :	SAND IS MED - COARSE CIRAINED
3			ł						Ц		WAL SOUTED ATT + ROLK FRAUS.
Sour							0				FRIABLE, MOIST
3											0-6'
ۍ د	Ļ		-	_				155		· '	
279717000	7	15	8.5	00	1		040	1,22		1	DEBROWN - BROWN SILTY CLAY
2 1			(*)	3			0				MOIST MOTTLED, PLASTIC
2						1			13.	7.	TR SAND 6-9 6-12'
	╆ .			=	‡		0			- :	102
740X	-	-			 	1	2		N'	1 -	SILTY CLAY TO 91
	1_	 	<u> </u>	-	-		1	CL	<u>II</u>	-	(LT 1510000 TO 1510000)
<i>y</i>	0			1					8	-	
40	189			3						-	SATURATED ZONE AT 9': (9-9.5
		40	N	9	1		4	A	9		200
i.	3 37			AGT GJA			'				SOY CLAY AS ABOVE, SATURATED

	FIE	ΞL	D	LC)G	0	F	30	RI	N(G (CONT'D.) SHEET 2 OF 2
•	œ		FEET RECOVERED			ED LAB.	HNUSCAN (PPM)	LITHOLOGIC CODE	HE (E		JOB NO. 3K98 TWILZO
T138 1500 T1368 1500	5000) 12-11		5 5	excercent Breezent)	4 0 3 0 0 0 1 1	SC	15 16 17 18 19 20	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	LITHOLOGY FROM 6-12.515 PREDOMINANTA A SANDY CLAY CLAYETSD SATURATED ZONE; HAVE CONSIDERABLE MORE SAND IL THEM (CLAYET SAND): GREY-BROWN MUTTLED CLAY W/TR SILT, SE STIFF, PLASTIC-MED. PLASTIC 12.5-27 (SD STRINGER AT 13 CLAY: AS ABOVE - MOTTLEW CLAY BELOM
Cari Serv	30 22-27	5	5	a Cocorres -)	0 0 0	МЬ	2.2 2.3 7.4 7.5 - 7.6 - 7.7 2.8		MUCH GRAYER IN COLOR RAPPER WET AT ZZL ZI J CLAY AS AGOVE SOFT, (SATURATED) PLASTIC, THACE OXIDE NODULES, AND F COALLE GRAINED SAND.
AuG									29 30 1 2 3 4 5 6 7 8 9		TD=30' Druller reports clan to TD
	NOT	ES:	•								

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MWIIZO

COFFCRATION	, ,
FIELD LOG OF BORING	SHEET OF
OL AN	PROJECT BORING NO.
BITCH	EAKER AGB BX Sweeth TW1120
	JOE NO. 3K98 LOGGED BY: JSB
@ rw., 20	PROJ. MGR. CJG . EDITED ET. BFN
\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	DRILLING COMPANY: A.W (80)
\$ 0 TW113	DRILL RIG TYPE: Mobile B-61
	DRILLING METHOD: Hollow sim ones
الم المار ح	DRELERS NAME: V. Barazza
[2]	TOTAL DEPTH (FT.) 30
	TIME 1019 DATE 1-7-92
	THUE DATE 1-7-92
	GROUND-WATER CONDITION AT
TORY SER	SOMPLETION OF UNITING
	BACKFILLED. DATE 1/9/12 SEE WELL COMPLETION
MPLE NUM MPL	WEATHER CONDITIONS Ptly clouds, light breeze
AN HER BONES ES ES TOUR	BURFACE ELEVATION
	COMMENTS
	GRASS AT SURFOLE
2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	
E 4	DK BROWN - BROWN GILTH SAND W/
2	SOME CLAY DELAN.CS PERSONAL
ز : او المحا	SAND IS MED - COLORE CALINOD
	LAL SORTED ATT + 11) CA FRALS.
3	FRIASLE MOIST
	0-6'
3.5. 3.5. 600D	
3 2 5 3 3 3 3 5 3 5 5 5 5 5 5 5 5 5 5 5	DEBROWS - GREEN SILIT CLAY
	TR SAND 6-9 6-12
	SILTY CLAY AS ABOUT TO 9'
2 cL	(LT Blows to Blows
30 1	
2000 1 200 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	SATURATED ZONE AT 9': (9-1.5'
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	SOY CLAY AS ABOVE : SA WARTED
Al	ZowE 11 = 11.5'

SENT BY:BROWN AND ROOT, ENV ;12-21-95 ; 4:21PM ; MW1120

	FI	EL	D	LC)G	0	Fil	<u> BO</u>	R	N	G (CONT'D.) SHEET 2 OF 2
٠.	SAMPLER	FEET	PEET PECOVERED	BAMPLE CONDITION	FIELD LAB. SAMPLE NO.	FIXED LAB. SAMPLE NO.	HNUSCAN (PPM)	CODE	DEPTH (FEET)		JOB NO. 3 KAY TWILZO
		·					4	2	رر رر		A SANDY CLAY / CLAYETS SATURATED
	12-17	2	\$0	T Excercent		J	0 3 0 0	در	15 - 16 - 17		TONCY THE CONSIDERABLE MOLE JANS IN THEM (CLAYEN SANS) GREY-BROWN MUTTLED CAY WITH SILT, SD STIFE & PLASTIC - MED. PLASTIC 12.5-27 (SD STRINGER AT 13')
1.00	50007 17-22	5	5	- Kreneni	1)	,	¥	18 20 21		CLAY AS AROUE - METTLE - DECREPCES BELOW 18.5' CLAY BELOWE MUCH GRAVER IN COLLE- RAPPEZ WET AT 22k 21 JS
Cour Sent		5	5	שנשושה	Į	`	0000	иĹ	23 ?4 25 26 27		CLAY AS AGOVE SOME (SITTLEATURE) PLASTIC, THACE OXIDE NODLYS AND HE COALLE ALANDO SAND.
i di Museul La	10,			1	1		1		28 29 1 2 3 1 2 3 4 5 6 7 8		TD=30' baller reports clay to Th
	TOM	E5:				•					

Halliburton NUS FIELD LOG OF BORING

WELL NO. MW1121 SHEET _ 1 _ OF _ 2

70)		<u>ÇOR</u>	POR	ATIO	N						_		
PRO.	ECT:			EAK	ER A	AFB F	RFI		JOB	NO.	:	01	
								,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	LOG	3ED	8	/ :	BDH TOTAL DEPTH OF BOREHOLE: 16.7
DRJL	UNG (CONT	RACT	OR:		Tri-S	tate	Testi	ាខ្វ				SURFACE ELEV.: DATUM:
DRIL	LER'S	NAM	E:	No	/	FR	3923						START TIME: CAR DATE: 4/8/95
ORIL	L RIG	TYPE:		C	ME		13						FINISH TIME: 0920 DATE: 4/8/95
BOR	NG M	ETHO	D:	H51	_	·							WATER DEPTH:
HOLE	DIAN	AETER	i:	74	// 	104	<u> </u>						DATE:
SAM	PLING	MET	HOD:	1	Mode	mon	1_						TIME:
HAM	MER \	WGT.:		N			I	НОТ	<u>: </u>	14			BACKFILLED, TIME: DATE:
SURF	ACE	COND	ITION	s :	۶	nos	2						WEATHER: Fair, lo 60'SF very strong wind, gusty
SAMPLE MYENVAL	SAMPLE TYPE	BLOWS / 8-NCHES	INCHES DRIVEN	WCHES RECOVERED	OVA READING (ppm)	MORSTURE	DENBITY	MUNSELL COLOR	LAB SAMPLE NUMBER	DEPTH IN FEET	STATE OF THE STATE	ГІТНОСОВУ	SKETCH OF BORING LOCATION
					1238								MATERIAL DESCRIPTION
						51.	لمد	104	ß.		H		
					U	11613	770	413		,	Ц	1.10	0.5 - 1.1 Silt, clayer, sdy,
											H		sortlera, sl. moret, ligan
					D		sefe	10 4		z	H	•	
			١	,		mai	-	6/3			Ц		1.1-2.9 Sand, well sorted, fine
2.7			27	2.7				WYR 5/3	2.7	7		2.9'	and, mount, pole brown
个			,		_	ه. ا		_	3.2		П		2.7-32' Ell -54 - MUII2 IA @ 0832
1			8		0			3/2		4	Ц	7.0'	2.9-4.0 Clay, slay, mina sol.
			•	3				الاهد			Ц		very mont to wet at sopy wat a
								4/3		ح ا	$\downarrow \downarrow$		3.4, very dark granish bon,
					0	هد							nottled sols / range on
							sol	<u> </u>		٤.	Ц		4.0'- 13.8' Clay, silvy, bry
							ľ			ľ			mother, vange by, die gray
					٥					7.			
A,						-							
7.7					0	mos	pm						
7'			,,	2.8						1			
,			5	1.0							П		
I]	П		
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NOTES:_ EDITED BY/DATE:____

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Halliburton NUS

FIELD LOG OF BORING

WELL NO. M 4/121

SHEET 2 OF 2

		<u>СОН</u>	POR/	ATIQ	Ŋ								0 114 BORING NO.: M 4/12/
PROJ	ECT:		EAKE	RAF	B RF	I		,		JOE	N S	0.:	0114 BORING NO.: M 4112
INTERVAL	SAMPLE TYPE	BLOWS / 6-WCHES	INCHES DRIVEN	RECOVERY	GVA (ppm)	MOISTURE	DENSITY	COLOR	BAMPLE NUMBER	DEPTH IN FEET	BITTEREN BURGATUTATION	LITH.	
										71:	H		11.7' Clay, law silk conduct, is firm
				·		والمسعر	۲	10 XX		12	H		
12.7					0		Jun			, , -	H		
1					٠					14	H	13-8	13.8'- 16.3' Clay, at sily fine
7			2.6	2.6	0	wi	gan.	y/I		,5.	H		reddisk erh blong old frontmer.
1										16	H		
163										,7	H		
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											H		
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		1		<u> </u>	<u> </u>	<u></u>	J		1		ليكيه		EDITED BY/DATE:

1	9 _	.01	-95		4:22PM
1	Z-	'Z. I	- 20	•	4 . 7.71 1/1

Halliburton NUS FIELD LOG OF BORING

WELL NO. MW1122

		COR	POR.	<u>A HQ</u>	N								
PROJ	ECT:			EAK	ER A	AFB F	RFI		JOB	NO.	:	0	114 BORINGWELL NO.: MW1122
									rog	GED	В	Y: -	BOH TOTAL DEPTH OF BOREHOLE: 17.9
DRIL	LING (CONT	RACT	OR:		Tri-S	tate	Testi	าด				SURFACE ELEV.: DATUM:
DRIL	LER'S	NAM	e :	Ope	1	By	yer						START TIME: 1236 DA E: 4/7/95
DRIL	L RIG	TYPE				- 5	5					· ·	FINISH TIME: 1430 DATE: 4/7/95
BORI	NG M	ETHO	D :	H	SA								WATER DEPTH:
HOLE	DIAN	METER	l:	71	"								DATE:
SAM	PLING	MET	HOD:			·	w						TIME:
НАМ	MER \	WGT.	:	N	4		DRO	P HGT	: N	A		*	BACKFILLED, TIME: DATE:
SURF	ACE	COND	ITION	8:	بر	nos	2	,				, ——	WEATHER: Fair, upper 703F, easterly and
BAMPLE INTERVAL	SAMPLE TYPE	blows / 6-inches	INCHES DRIVEN	INCHES RECOVERED	OVA READING (ppm)	MOISTURE	DENSITY	MUNSELL COLOR	LAB BAMPLE NUMBER	DEPTH IN REET		LITHOLOGY .	SKETCH OF BORING LOCATION
													MATERIAL DESCRIPTION
					0	ציגנ	a fr	20]			L		0.5 - 1.1 Sand, fine grand, sity;
0.5						0	770	4/4		١, .).)	sh cloupy, Northers, it is bin.
					0	چا. ای	هـ	2.54			L		1.1'-1.8 land, fine grand, silvy;
						צינות	77	6/4				1.9	st. most, like nellowy byen
V			23	23		•		254		1			18'-32' Clay sandy at ton silver,
2.K					0	محالات		412	1		Γ		done maint from north more from
<i>1</i> -7										13.	1	-32	and the second
					0					ŀ			22/51 10m it les lie long
						-	-	2.5	-	4-	1		mouled mange by mon of
					D	لهيس		51)					motted manage in, month
-	-		,						_	5		-5-1	4.8 - 3.3 E11-34-1-W 11-34 A 11-30
			5.0	5.0			sof	2.5	1		F		B. A. Sand State of S
坐_	_				0			413	-	6	\dagger	ين له	ormalismon, most
						النبد	ŀ	py	1		ŀ		6.2 - 9.7 Chay sales , both , and best
ROCKET!					0	424	_	4/		7.	╀	1	Fund from most
							,				ŀ	27	7.7-9.1 Send very first grand, silly,
28										8.	╀		light olive thour first
					0	سحو	90gK	2.5	<i>.</i>		L		
					0			5/3		19.	-	9.1	9.1-11.7 Clay, st. sty, norther light
1						ر.	k :	10 YR			-		blink gray, she low, orange has, moist
لــــا						31/2		6/2	L	مبا		<u> </u>	
_										-			

EDITED BY/DATE:__ MOTES:__

SENT BY: BROWN AND ROOT, ENV ;12-21-95 ; 4:23PM ;

Halliburton NUS

FIELD LOG OF BORING

WELL NO. MW1122

SHEET 2 OF 2

		COR								<u> </u>			0114 BORING NO.: MW1122
PROJ	ECT:		EAK	RAF	B RF	1				JOB	N	0.:	0114 BORING NO.: MWILL
INTERVAL	SAMPLE TYPE	BLOWS / 6-ENCHES	INCHES DRIVER	RECOVERY	OVA (ppm)	MOISTURE	DENSITY	COLOR	SAMPLE NUMBER	DEPTH IN FEET	A COMPANY OF CHARACTERS OF CHA	стн.	
				•						11-	H		
->			5.0	5.0	0	دى	fin	2.5Y 5/2		12 -		11:7	11.7'-17.9' Plan, sl. silvy, growish born,
5.8										3 -			11.7'-17.9' floy, sl. sily, gravish bon, mould resent bu to ledith form, slop frotted.
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			-							16-	H		
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NOT	-												EDITED BY/DATE:

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Halliburton NUS

FIELD LOG OF BORING

WELL NO. MW1123

	9	COP	POR	ATIC	M											
PRO	ECT:			EAK	(ER A	AFB f	RFI		JOB	NO.:	. (0	114	BORING/WELL N	0.1 MW 11	23
									LOG	ŒĐ	BY:	6	> Millar	TOTAL DEPTH O	F BOREHOLE:	
DRIL	LING C	ONT	RACT	OR:		Tri-S	tate	Testi	ng				SURFACE ELEV.:		DATUM:	
DRILL	LER'S	NAM	E:	Joh	0Y).	િ	ra	wf	bro	}			START TIME: 15	35	DATE: S)	1195
ORILI	L RIG	TYPE	<u>.</u> (, W 1	6	75)						FINISH TIME: 173	30	DATE: 5/1	1195
BOR	NG M	ETHC	D: 7	144	4514	DVA	250	lvi li	rd	wil	IKS A	•	WATER DEPTH:			
HOLE	DIA	ETE	R: \	5 "						7			DATE:			
	PLING				w K	O 17	~	. <	2 N	Λρ	line	7	TIME:			
E	MER V							P HQ1		W		•	BACKFILLED, TIME:		DATE:	
	ACE					ras					سنسند		WEATHER: 1-to+;	Humid:	950F,	Sunny
GAMPLE INTERVAL	SAMPLE TYPE	BLOWS / 6-NCHES	MCHES DRIVEN	INCHES RECOVERED	OVA READING (ppm)	MOGSTURE	DENSITY	HINSEL COLOR	LAB SAMPLE NUMBER	DEPTH IN PEET	ПТНОГОВУ		diter MWHZ4	ETCH OF BORING	LOCATION	Two;tet
														MATERIAL DESCR		
ĵ	37.4	1	351	3FI	17	Mois	214	314	1				0.5'- 3.0'			•
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					0/			1000			5	4	Chang	at 151.	to LIDYR	4/4
	į				10			1975	<u></u>	Z	2		yellorursh	brn the	en back	· +0
		7	\prod		0/		317	134					104R314	at sf	t. Sand	د ا
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					} `						H		brn;	appear	<u>a 'ami</u>	natio
3			الم	1	۱.,	401	Joen	Invie	-	ķ	M.	۲.,				
	SFT 3.5 0/ SAT YIM 348												8.0' - 9	5' - 5	<u> </u>	2000
1		4	 -	\coprod	10	11	1	11		þ	le le		Sand	vfg; b	<u> </u>	JUK 2/6
			$\ \ $	\prod	10/		34					١.	Vellow	ish brn	1 no Hli	ng.
				\coprod	10	1			<u> </u>	12		,			<u> </u>	

EDITED BY/DATE:_

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Halliburton NUS

FIELD LOG OF BORING

WELL NO. MW1123

SHEET OF 3

yellmish brn; sit plastic yellmish brn; sit plastic 13.0' - 15.0' - CLAY: trace 3:1t; grayish brn w multiple root casts / worm multiple root casts / worm surrows throughout. Filed w/ 2.5 yelle dk red silty sand material. some root structures still intact, some Chicke; sit. plastic 15.0' - 19.5 - CLAY: trace silt. dark gray; some worm burrows / root cast but not generally some worm burrows / root cast but not as many as 13.0-15.0'	Ä		COR	POR	ATIC	N								
HALL TO SEE SET OF SET	PRO	ECT:		EAK	ER AJ	FB RF	7				101	~	0.:	0114 BORING NO.: MW1123
trace Vfg Send; brn Sence roots; rout Cests + Worm burrows mothed wy 10 yests yellowish brn; sit plastic 13.0' - 15.0' - CLAY: trace Sit; grayish brn w multiple coot cests; worm burrows throughout; Gired will send material. Some root structures still intact, Some Chicke; slt. plastic 15.0' - 19.5 - CLAY: trace sit: dark gray; some worm burrows / coot cast but rot as many as 13.0-15.0' Worm burrows 9; led w 2.5ye 416 dk red material; not plastic until 1 g noted. No worm burrows lycot casts but not plastic until 1 g noted. No worm burrows lycot casts but not chicke noted.			_					DENSITY	cotos	BAMPLE NUMBER	DEPTH IN FEET	A section of the sect	LITH.	
						00 100000000	Sit:	24	DOK Sp2		12 13 14 15 16 17 18 19		7	trace VFg sand; brn some roots; root (195ts tuberm burrows mothed wy 10483/4 yellowish brn; 51t plastic 13.0' - 15.0' - CLAY: trace 3:1t; grayish brn w multiple root casts I worm burrows throughout; Filed w/ 2.548414 dk red silty sand material some root structures still intact, some Chiche; 51t. plastic 15.0' - 19.5 - CLAY: trace silt. dark gray; some worm burrows I root cast but not as many as 13.0-15.0' Worm burrows filed w 3.548 414 dk red material; not plastic until ~ 19.0' when more silt is noted. No worm burrows I rootcasts below 18.0' but seme Inliche hoted.

EDITED BY/DATE:

Halliburton NUS FIELD LOG OF BORING

WELL NO. MW 1124

SHEET		٥F	
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PROJECT: EAKER AFB RFI JOB NO.: 0114 LOCAD BY: G1 M' LOCAD B			COF	RPOF	RATI	NC								UILL			
DRILLING CONTRACTOR: Tri-State Testing DRILLER'S NAME: John Crowdford START TIME: C930 DATE: Sli2195 DRILLER'S NAME: John Crowdford START TIME: C930 DATE: Sli2195 DRILLER'S NAME: John Crowdford START TIME: C930 DATE: Sli2195 DRILLER'S NAME: John Crowdford START TIME: C930 DATE: Sli2195 DRILLER'S NAME: John Crowdford START TIME: C930 DATE: Sli2195 DRILLER'S NAME: John Crowdford START TIME: C930 DATE: Sli2195 DRILLER'S NAME: John Crowdford START TIME: C930 DATE: Sli2195 DRILLER'S NAME: John Crowdford START TIME: C930 DATE: Sli2195 DRILLER'S NAME: John Crowdford START TIME: C930 DATE: Sli2195 DRILLER'S NAME: John Crowdford START TIME: C930 DATE: Sli2195 DRILLER'S NAME: John Crowdford START TIME: C930 DATE: Sli2195 DATE: John Color Time: John Crowdford START TIME: John Color Time: DATE: John Color Time: DATE: John Color Time: DATE: John Color Charler START JOHN Color Charler START JOHN Color Charler START JOHN Color Charler START JOHN Color Charler START JOHN Color Charler START JOHN Color Charler START JOHN Color Charler START JOHN Color Charler START JOHN Color Charler START JOHN Color Charler START JOHN Color Charler START JOHN Color Charler START JOHN Color Charler START JOHN COLOR JOHN COLOR JOHN COLOR JOHN COLOR JOHN COLOR JOHN COLOR JOHN COLOR JOHN COLOR JOHN COLOR JOHN COLOR JOHN COLO	PROJ	ECT:			EA	KER	AFB	RFI		JOB	NO.	: 4	2114	BORING/WELL N	o.: M	Wil	24
DRILLER'S NAME: Tohn Crowford START TIME: C930 DATE: 8/12/95 ORILL RIG TYPE: CAF-75 BORING METHOD: 7'4 HSA OVER DRIVEN JULY HSP WATER DEPTH: HAMMER WOT.: NA DROP HOT: NA BACKFILLED, TIME: DATE: SURFACE CONDITIONS: GraSSJ WEATHER: HO + HAVING 95°F SUMM WE SHOW HOW HOW HOW HOW HOW HOW HOW HOW HOW										LOG	GED	BY: (g, millar	TOTAL DEPTH O	F BOREH	OLE:	
DRILL RIG TYPE: C N F - 75 BORRING METHOD: 7 1/4 HSD OVER DVILLED WITE DATE: BORRING METHOD: 7 1/4 HSD OVER DVILLED WITE DATE: DATE: SURFACE CONDITIONS: DATE: SURFACE CONDITIONS: DATE: SURFACE CONDITIONS: DATE: SURFACE CONDITIONS: DATE: SURFACE CONDITIONS: DATE: SURFACE CONDITIONS: DATE: SURFACE CONDITIONS: DATE: SURFACE CONDITIONS: DATE: DATE: SURFACE CONDITIONS: DATE: DATE: DATE: DATE: SURFACE CONDITIONS: DATE: DATE: DATE: DATE: SURFACE CONDITIONS: DATE: DATE: DATE: DATE: SURFACE CONDITIONS: DATE:	DRILL	ING (CONT	RAC'	TOR:		Tri-	State	Test	ററ്റ			SURFACE ELEV.:		DATUM	:	
DRILL RIG TYPE: C N F - 75 BORRING METHOD: 7 1/4 HSD OVER DVILLED WITE DATE: BORRING METHOD: 7 1/4 HSD OVER DVILLED WITE DATE: DATE: SURFACE CONDITIONS: DATE: SURFACE CONDITIONS: DATE: SURFACE CONDITIONS: DATE: SURFACE CONDITIONS: DATE: SURFACE CONDITIONS: DATE: SURFACE CONDITIONS: DATE: SURFACE CONDITIONS: DATE: SURFACE CONDITIONS: DATE: DATE: SURFACE CONDITIONS: DATE: DATE: DATE: DATE: SURFACE CONDITIONS: DATE: DATE: DATE: DATE: SURFACE CONDITIONS: DATE: DATE: DATE: DATE: SURFACE CONDITIONS: DATE:	DRILL	ER'S	NAM	E:	Jo	hr	`	Cro	سن	For	-d		START TIME:	0930	DATE:	8/12	495.
BORING METHOD: 7'44 HSA CVEY CIVILED MINISTER WATER DEPTH: HOLE DIAMETER: 10" SAMPLING METHOD: CONTINUES SAMPLING TIME: SAMPLING METHOD: CONTINUES SAMPLING HAMMER WATER CONDITIONS: SUPPACE CON	ORILL	. RIG	TYPE										FINISH TIME:	1.915	DATE:	8/12	2195
HOLE DIAMETER: 10" SAMPLING METHOD: CON 11 NOOLS SAMPLING HAMMER WOT: NAT DATE: SUMPACE CONDITIONS: Grassy WEATHER: 16 + Humid 95°F Sum WEATHER: 16 +	BORII	M DI	ETHO						drill	ed a	a) (אלא יכ	WATER DEPTH:				
SAMPLING METHOD: Con ti nocus Sampling HAMMER WOT: NA DROP HOT: NA BACKFILLED, TIME: SURFACE CONDITIONS: Grassy OF HAMMER WOT: NA DROP HOT: NA BACKFILLED, TIME: DATE: WEATHER: 140 + Hurnid; 95°F SIMM WATHER: 140 + Hurnid; 95°F SIMM OFFICE AND SHAPE BUILDING													3				
HAMMER WOT.: NA DROP HOT: NA BACKFILLED, TIME: DATE: SURFACE CONDITIONS: Grass WEATHER: 1+0+: Humad; 95°F Sinne WEATHER: 1+0+: Humad; 95°F						n ti	∧ ċ	ocu	<u>s</u>	íar	∼ ₽	dina	TIME:				٠.
SKETCH OF BORNE LOCATION SKETCH OF BORNE LOCATION MATERIAL DESCRIPTION ST. 1.5" - Claying an inches of an								1				,	BACKFILLED, TIME:		DATE:		
SKETCH OF BORNE JOCATION SKETCH OF BORNE JOCATION MATERIAL DESCRIPTION ST. 1.5" - Claying SILT; Some Sand, fg angular grain The sand of yellowish brn. SM yellowish brn. SM yellowish brn. SM yellowish brn. SM yellowish brn. SM yellowish brn. SM yellowish brn. SM yellowish brn. SM yellowish brn. SM yellowish brn. SM yellowish brn. SM yellowish brn. SM yellowish brn. Some clay, 3H. Cohesive Vind & grayish brn. Jaminated wil yellow, 3h brn. Color. Some mustovite, vry dk grayish brn. Color. Some mustovite, vry dk grayish brn. Some clay in the sand will sorted; an gular; brn. Color. Some mustovite, vry dk grayish brn. Some clay in the sand will sorted; an gular; brn. Color. Some mustovite, vry dk grayish brn. Some clay in the sand will sorted; an gular; brn. Color change O 35' To grayish brn wi over 416 dk To grayish brn wi over 416 dk To grayish brn wi over 416 dk To grayish brn wi over 416 dk To grayish brn wi over 416 dk To grayish brn wi over 416 dk To grayish brn wi over 416 dk	SURF	ACE	COND	ITIO		****	as	SU					WEATHER: 140+	Humid:	95	o F .	SINUL
SECRETA DESCRIPTION MATERIAL DESCRIPTION S' 1.5" - Claying SILT; Some Sand fa angular grain Mu Some Sand fa angular grain Mu Some Sand fa angular grain SM CP SOME Clay, SM. Cohesive Vey dk grayish brn. SM CP Vey dk grayish brn. Isminated wy yellow. Sh brn Color. Some muscovite, vey dk grayish brn. Some muscovite, vey dk grayish brn. Some muscovite, vey dk grayish brn. Some muscovite, vey dk grayish brn. Some muscovite, vey dk grayish brn. Color. Some muscovite, vey dk grayish brn. Mu of state of stat			٧.						OLOR	E NUMBER	٠	and the second				`	. ฟ.
Some Sand fa an wallan grain Some Sand fa an walan grain Mu Some Sand fa an walan grain Mu Some Sand fa an walan grain Mu Some Clay, 3H. Cohesive Viy dk grayish brn. Jan 1 - 2.3' - Sandy allet; Some Clay, 3H. Cohesive Viy dk grayish brn. Jan 1 - 2.5' - AND; Vfa; Well sorted; an swar; brn. Janinated wij yellow. sh brn Color. Jeninated wij yellow. sh brn Jeninated wij yellow. sh brn Color. Jeninated wij yellow. sh brn Color. Jenin	SAMPLE INT	SAMPLE TY	BLOWE / 6-I	ENCHES DRN	INCHES REC	OVA READIN	MOISTURE	DENSITY	MUNSEL C	LAB SAMPLI	DEPTH IN FE	7	SKE	7		in .	\ \
Mu Some Sand fa angular grain ports; dk yellowish brn. sme Sand fa angular grain mars; dk yellowish brn. sme Clay; 3H. Cohesive vey dk grayish brn. sme Well sorted; an gular; brn. laminated up yellow. sh brn color. some muscovite, vey dk gray brn. Color change & 3.5' to grayish brn up ovr416 dk red mothlein.	200						***							MATERIAL DESCR	IPTION		
Mu Some Sand, fa anjular grain mats; dk yellowish brn. SM ce SM ce 1.51-2.3'- Sandy SILT; Some Clay, SH. Cohesive vy dk grayish brn. Mu vy dk grayish brn. Some clay, SH. Cohesive vy dk grayish brn. Isminated wy yellow. Sh brn color. Some muscovik, vy dk gray brn. Color change & 3.5' to grayish brn wy oyr416 dk red mothlein.	.5 P	المنالة	אַע	5°'	14.5	0/	mole	جمعا	3,4			A	.5- 1.5	- Clar	141	SIL	T
SM Ce Sandy SILT; Some clay, SH. Cohesive vy dk grayish brn. Some clay, SH. Cohesive vy dk grayish brn. Some clay, SH. Cohesive vy dk grayish brn. Some clay, SH. Cohesive vy dk grayish brn. Some clay, SH. Cohesive vy dk grayish brn. Some muscovik angular; brn. Some muscovik, vy dk grayish brn wy ovry dk grayish brn wy ovry 4/6 dk To grayish brn wy ovry 4/6 dk To grayish brn wy ovry 4/6 dk To grayish brn wy ovry 4/6 dk						10].	ML	Some 5				
5 Some Clay, SH. Cohesive Vey dk grayish brn. Some Clay, SH. Cohesive Vey dk grayish brn. Some Clay, SH. Cohesive Vey dk grayish brn. Isminated wy yellow. Sh brn Color. Some museovik. Vey dk grayi brn. Color change. D 3.5' to grayish brn wy over 416 dk red mottlein.						0/			\prod	A	ľ						
5 Some clay, SH. Cohesive Vey dk grayish ben. 137 30 more sati 14 Some clay, SH. Cohesive Vey dk grayish ben. 15 Some clay, SH. Cohesive Vey dk grayish ben. 15 Some clay, SH. Cohesive Vey dk grayish ben. 15 Some museovite of sular interest of the color change of 3.5' 15 Some museovite of the control of the color change of 3.5' 15 Some museovite of the color change of 3.5' 16 Some museovite of the color change of 3.5' 17 Some museovite of the color change of 3.5' 18 Some museovite of the color change of the color c	11		1		}	6		114	15	Щ		SM				-	
Some Clay, Sh. Cohesive vey dk grayish brn. 23'- 2,5'- SAND; veg; well sorted; an sular; brn. Igminated wy yellow. sh brn celor. 35'- 45'- Clayer 5'ILT Some museovite, vey dk gray brn. Color change. O 3.5' to grayish brn wy oyr4/6 dk red mottlein.	\Box	\prod	T		П	0/		IT			2		7	· - Sax	du		 ·
Some muscovik, vry dk grayish brn. Some muscovik, vry dk grayish brn. Some muscovik, vry dk grayish brn. Some muscovik, vry dk grayish brn. Color change & 3.5' to grayish brn w/ 104R4/6 dk red mottlein.		11				0		Sacr	37	R		7-	50.018 0		•		,
5 John Jan Jan Jan Jan Jan Jan Jan Jan Jan Ja	11	\Box	П	1		7	1	H	7	7	3	المار		• •		٥٨٥	
5 37 30 0/more 30; D. J. J. J. J. J. J. J. J. J. J. J. J. J.	11			1		1 <i>7</i> .		Ш		40			vyako	grayish	orn.		
Jaminated wy yellow. sh brn color. Jaminated w	++	\dagger	1-1	1		^	+	+	3/2	-	4		_)			_
Jaminated wy yellow. sh brn color. Jaminated w	1	11	1		1	/	' '	,		S		inct In wat	3.3'- 2.3	. 3/1/	7	veg	,
Jaminated wy yellow. sh brocolor. Calor. John Some muscovik, vry dkagray brocolor change & 3.5' to grayish brown wy over 4/6 ak red mottleine. Mile Mile Mile Mile Mile Mile Mile Mile	71	╁	1-	ब हर	351	07	moks	521		ш	5			, ,	SULA	ن ک	brn
Some muscovite, vry dk gray Some muscovite, vry dk gray brn color change & 3.5' to grayish brn wy ovr4/6 dk red mottleine D/ mont sitt avr BE ML ML ML ML ML ML ML ML ML M							[]			PL		H		ed wy	le 110 1	v. 36	brn.
Some muscovik, vry dk gray Some muscovik, vry dk gray brn color change & 3.5' to grayish brn wy royR4/6 dk red mottleine	╌┼╌┼	++	╁	+	-	μ,	#	Н-		-	6		Culor.				
Some muscovik, vry dk gray Some muscovik, vry dk gray brn color change & 3.5' to grayish brn wy royR4/6 dk red mottleine	11	11	1			9				A C		ļ					
Some muscovik, vry dk gravi brn Color Change & 3.5' to gravish brn wy 104R4/6 dk	1	++		\perp	-	<u>/°</u> ,	D.#27	Ц		7	7	K	3.51 - 4.51	- Claye	4 5	ILT	
brn Color change & 3.5' to grafish hrn w/ 104R4/6 dk red mottleine				}		<i> </i>				0			Some m	uscovite	٧,	y di	c greyth
To grafish brn w/ 1848 ak red mottleine	\$				225	۷,	200	4		ス	9	<u> </u>	brn. c	olor cho	nge.	_0	3.51
D/ most sir rave	3	ا ماد	(6	1	⊺ / .							to graji	sh brn w	,oy	R4/6	dk
	11					10		331	Ш				red mot	llein.			
]						0/	moist	31t	AYR 3!1		[ML	the .	9			
4.5'- 7.0' - SILT areyish bro		Ш	}			Þ					ب		4.51- 9.01-	SILT	a.	مورا زو	sh brn.

NOTES: drilled to determine if contaminationEDITED BYIDATE:

FIELD LOG OF BORING

WELL NO. NWI(24

SHEET ____ OF ____

PRO	JECT:	<u> </u>	EAK	ER A		 Fl				JOE	8 NO.:	01)4 BORING NO.: MW1124
INTERVAL	SAMPLE TYPE	BLOWS / 6-INCHES	INCHES DRIVEN	RECOVERY	OVA (ppm)	MOISTURE	DENSITY	COLOR	SAMPLE NUMBER	DEPTH IN FEET	ист. ЦТН.	
13			557	54	0/0 0/0 0/0 0/0		200	e de la companya de l		13	とい	trace sand ufg; trace clay, more clay from 6.0' - to 6.3'. mothed throughout wilde yellowith bra; from 9.0'-9.0' more clay. 9.0'-14.0' - Siety CLAY, root Casts; worm burrows;
			SOT		100000000000000000000000000000000000000	Page 1	733	10×16	ED FOR AURLYSI	17 19 24 7J 24 23	CH	reats, some intert carbonized root structures, grey w/ 254e 4/8 dr red; plastic 14.0' - 18.0' - Clay; irace sitt dr gray, some Vertical seams filled w/ 194e 5/8 verticals beams
24	1424-32		io Fr	T CQ	0/	SAT	3	व व व व व व व व व व व व व व व व व व व	No SAM	25 26 27		23.0' - 26.0' Sandifilty CLAY; Sand is med grained; angular; Well screed; dk grey w/ some layers mottlin; some vary Small root costs; or worm burrows. 266 38.0' - SAND; med grained angular; well sorted; qtr. yellowish br.

FIELD LOG OF BORING

WELL NO. MWIZY

CHEET	OF	

747		ועע	RPOR	AIL	217					~~~			
PROJ	ECT:		EAK	ER A	FB RF	7		,	·	JOI	NO.	סווט	BORING NO .: MW1124
INTERVAL	BAMPLE TYPE	BLOWS / GAICKES	MCHES DRIVEN	RECOVERY	OVA (ppm)	MOISTURE	DENSITY	COLOR	BAMPLE NUMBER	DEPTH IN FEET	LITH.		
	۸۸	MF	1001	ום בען	%	595	icess	1016					
11	1	-	\Box	-	7	4				31		continued drilling	
	1	11			0/0	1					H	+ TD of 38' - N	e sampling from
11	十	11			c/					32		2	
4	_	 _	-	Ц.	10					33	SW		
					%			{	S			TD - 38'	
\forall	1		1		0/					ઝ૫			
41	1				/			4	S	35	i I		
11					%				7				
++					K	11	+		NAC	36			
\coprod	\perp				90	4	\perp			37			
1					%								
<u> 36</u>	-		-		/-			- -	-0R	38	1	,	
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IOTES	: -											EDITED BY/DATE:	

EDITED BY/DATE:

13038318208;#13/21

SENT BY: BROWN AND ROOT, ENV ;12-21-95 ; 4:25PM ;

Halliburton NUS

FIELD LOG OF BORING

WELL NO. MW1125

#HEET ____ OF ____

	ς	ORF	ORA	TIO	<u> </u>							
PROJ	CT:		1	EAKI	R A	FB R	FI		108 N			BORING/WELL NO.: MW1125
İ									LOGG	ED B	Y: (7-, 19-, 11au
DRILL	ING C	ONTR	ACTO	XR:		Tri-S	tate T	estin	0			SURFACE BLEV.: DATUM:
DRELL					<u>a</u>	Cro	س	foc	<u>d_</u>			START TIME: 0528 DATE: 10/31/95
DAILL												FINISH TIME: 0925 DATE: ///01/95
BORI	IG ME	THO	o:7%	א ווני	KA (Ove	rdri	illed	W	10"	HSA	WATER DEPTH:
HOLE												DATE:
5AMI					מלו	ناص	s 5	an	npl	inc		TIME:
	MER V			JA			DROF	нат	: ኦ	JĄ.		BACKFILLED, TIME: DATE:
SURF	_	_			- ra	53	u_					WEATHER: Overcast; 50's - 70's; slt. breeze
SAMPLE INTERVAL	SAMPLE TYPE	BLOWB / G-INCHES	INCHES DRIVEN	INCHES RECOVERED	OVA READING (ppm)	MOISTURE	DENSITY	MUNBELL COLOR	LAB SAMPLE NUMBER	DEPTH IN FEET	LITHOLOGY	
20000		# 0.0		liegs.					2011	ST.		MATERIAL DESCRIPTION
	70	700	22	OVE PAY	195	-		100		2 4 6 8 0 12 14 6		See boring log for MWI124, drilled 3/12/95 for description of lithology from Surface to 18.0. Summany of lithology from Surface to 18.0': 0.0'-1.5'-Clayey SILT 1.5'-2.3'-Sandy SILT 2.3'-2.5'-SAND 2.5'-4.5'-Clayey SILT 4.5'-9.0'-SILT 9.0'-14.0'-SILT 14.0'-18.0'-CLAY
18	1	- NA	SFI	357	%		4	420	3	814		

NOTES: Drilled to determine extent of Contamin- EDITED BYDATE:

NOTES:__

Halliburton NUS FIELD LOG OF BORING

WELL NO. MW1125

SHEET 2 of 2

		COR	POR	ATIO	N							
PROJ	ECT:		EAK	ER AI	B RF	1				JOB	NO.:	0114 BORING NO.: MW1125
MTERVAL.	SAMPLE TYPE	BLOWS / B-INCHES	INCHES DRIVEN	RECOVERY	OVA (ppm)	MOISTURE	DENSITY	COLOR	SAMPLE NUMBER	DEPTH IN FEET	LITH.	
	(°)	ALI	5FT	युज्ञ	%	ونالم	31166 31166	242		21 .	CL	18.0'-20.0'- Silty CLAY: Clayey SILT; brn. WIOYR 5/6 Yellowish brn. motting; some root structures and
23 23			257	25	%	松				22 23	CL	20.0' - 21.0' - CLAY: trace Silt;
					0/	597	LEOS	202 203 303			SN	mottles; some from 1048513 mottles; sit plastic
					/_					2L 27	5P	gray; sand is morly sorted, some mud, and some fa sand, angular; @ 24.0' is a 2 inch verticle sand seam
28								_	-	25 29		Sand is fig to med an aired 54R 518 yellowish red and angular
		-			8					3·		24.5'- 25.0'- SAND; Well Sorted fg sand; angular; gray, 25.0'- 25.5'- SAND; Dorly
			2		1) P		5)		3L 33		sorted mg-fg; angular Atz; some coarse grains; muet: colored a ains, overall color loves sie yellowish
		\ \2 \2		35	20	50°	3			34		25.5'-28.0' - A3 above
		<u> </u>				-				26		TD = 38
1		,	-							38	H	
											<u>H</u>	

EDITED BY/DATE:_

FIELD LOG OF BORING

WELL NO. MW 1126

SHEET _____ OF _____

		CORF	ORA	TIO	Ŋ									. (
PROJ	ECT:		•	EAK	ER A	FB R	Fi		JOB N			114	BORING/WELL NO		24 12
									Logo	ED B	٧: <u>چ</u>	Millar	TOTAL DEPTH D		83.0.74
DRILL	LING	CONTR	LACTO)#:			tate T			•		SURFACE ELEV.:		DATUM:	
DRIL	LER'8	NAME	: 7	Tor	m (<u> (}~0</u>	w	For	<u>-d</u>				0 27	DATE: 110	1195 Aroux
		TYPE:		ME	_	75						FINISH TIME: /	900	DATE: 11 6	195 grow
BORE	NG N	ETHO	D:7%	"HS	AOV	rerd	ville	du	1/1D	" H:	SA	WATER DEPTH:			
		METER										· DATE:			
SAM	PLIN	g MET	HOD:	ردی	rtir	700	3US	<u> </u>	m.	<u>eli</u>	<u> </u>	TIME:		<u></u>	1
		WaT.:		NA			DROP			JA		BACKFILLED, TIME:		DATE:	
SURI	FACE	COND	ITION	8: <i>(</i>	Gra	255	šu.					WEATHER: OVEY	cast 50's	- 605	
Bample interval	SAMPLE TYPE	BLOWS / 6-INCHES	INCHES DRIVEN	INCHES RECOVERED	OVA READING (ppm)	MOISTURE	DEKSITY	MUNSELL COLOR	LAB SAMPLE NUMBER	DEPTH IN FEET	LTHOLOGY	MW 423	SHOOPETTE		Ounist.
1	*****		6.11 A & A		Z DECK							75	MATERIAL DESC		
			0			000				2 4 9 8 10 12 14 16 18		5ee bor for lithe Summar 0.0'-18 0.5'-1.1' 1.1'-2.9 2.9'-4.0 4.0'-13: 13.8'-16	- Jander - J	cm 0.0 IWIIZI f 1, Clay! 1, Cg. 4, CLAY	18-6-
19	1 5.2.2 1 1 1 1		551	3.3	0/		3	4 (2)		20	C	1			· ub els-

NOTES: Drilled to determine presence or EDITED BYDATE: Ja Ellin 11/20/10

FIELD LOG OF BORING

WELL NO. 14 Wil26

SHEET 2 OF 2

CORPORATION PROJECT: EAKER AFB RFI 0114 JOE NO.: BORING NO.: MW/126 BLOWS / B-INCHES BAMPLE NUMBER NCHES DRIVEN BAMPLE TYPE DEPTH IN FLEET DVA (ppm) RECOVERY MOISTURE NTERVAL DENSITY COLON SOF 53 18,01-20,3 -CLAY - 314. olk gray some root structure 2) 0 CH 22 20.3'-21.3' - As above WI Color change to brn. 0/36 34 37 0 23.0'-25.0' - CLAY : 3070 sand; poorly sorted angular 0 fine marks med: coarse avan. 0 sit plastic 6 26 CL Some reat casts worm Veins Filled WI burrows 0/ rellowish red 27 25.0'-28.0'- Sandy CLAU ak gray; angular: fa coarse onawed, voins 0 uellowis 36 SP 5~ 0 E 3(28.6-29.21-Sandy CLAY sand is as above colored mairis 33 & (Well installed at the 11/25/25 * 1.0° - THOUGHT TO BE SAND BASED ON DRUL CUTTINGS AND ADJACENT BOAL HOLE DATE.

NOTES: Due to recommity of ACTACENT HOURS & TIME UNITATIONS, A COMPLETS SOIL DESCENPRON NOT PERFORMED & THU

EDITED BY/DATE: JRGIL 11/2/45

LOCATION

13038318208;#17/21

SENT BY: BROWN AND ROOT, ENV ;12-21-95 ; 4:27PM ;

Halliburton NUS

FIELD LOG OF BORING

WELL NO. MW1127

SHEET _____ OF _____

	•	CORF	20R	ITIO	N									
PROJ					ER A	FB R	Fl].	JOB N	10.:				.: MW1127
""				117	/1	• •	-	-				r. Millar	TOTAL DEPTH OF	BOREHOLE: 28.0'
Dom ,	LING	:OMTE	LACT!	DR:		Tri-Si	tate T					SURFACE ELEV.:		DATUM:
	LER'S				_							START TIME: 16	34	DA'E: 11/02/95
•	L FLIG			می	1€	<u> </u>	·5					FINISH TIME: 140	00	DATE: 11/08/95
ROST	NG LI	ETHO						Nec	JW	10"	HS/4	WATER DEPTH:		· .
	DIAN											DATE:		
	PLING				tir	וטטו	us	Sai	~p	lin	a	TIME:		
	MER V			NA			DROP	HGT	: ^	JA		BACKFILLED, TIME:		DATE:
						a s	su					WEATHER: OVER CO	1st; breez	4 40'5-50'5.
SAMPLE INTERVAL	2											1 <u>1</u>	MWIIZZ	LOCATION
27220		I. — I	-		122			22.63	1025				MATERIAL DESC	
T	1,35,00	780022	*****							П		See borio	100 .4	for MWIII6
\	1								L			drilled 12	licks for	- lithology
-	7	-								2				e to 18.01.
	\	RX							L	4				
		17]				
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	\top	†	汶	b						6				
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								1	11		H			•
13	105	NA.	SFT	55	- Deer	122	1557.	199	:	18	쒼	18.0' - 19.0	1-5:141	CLAY/ Clayey
11	555	11	1)	1.		The s	3/2	1910		1_	cu		u tiple.	sngall root
1 1	1 1	1 1	1 /	1 1	7 [1. T-	1 1	1 '	1	120	15			والمرابعة المرابعة والمستقدين في والمستقد

NOTES: Drilled to determine the absence or presence EDITED BYIDATE: # EDITED BYIDATE: # EDITED BYIDATE: # SUP.

FIELD LOG OF BORING

WELNO. MW1127

SHEET 2 OF 2

CORPORATION 0114 BORING NO .: MW1127 JOB NO.: EAKER AFB RFI PROJECT: BLOWS / 6-INCHES BAMPLE'NUMBER INCHES DRIVEN DEPTH IN FEET **GAMPLE TYPE** OVA Ippm RECOVERY MOISTURE MTERVAL DENSITY COLOR Ë 511 <u>کن</u> Structures Iworm burrows WIL filled WI SUR 518 yellowish red material loverall color brn. حد 22 9.0'- 24.5' - CLAY some **73** SFT 3.8 SILT root Structures / Worm burrows to 21.0' then less root structures but some 1215 1648512 brn. mottles, Some fg-mg, poorly sorted sand. 5W overall color dk gray 24.5'- 26.0' - SAND, Vfg-fa. SP Well sorted; angular, dk gray Peat-like material from 28 25.0' - 25.2' ak black 26.0'-29.0' - Vfq - mg SAND Well-rm. poorly sorted, brn, Ko2 angular grains 9+z. TD = 23.0 36.5 Sp. 33

NOTES: DUE TO PROXIMITY OF HOLES & TIME LIMITATIONS

This Location.

EDITED BYDATE: LCGlls

FIELD LOG OF BORING

WELL NO. MW1128

SHEET ____ OF _3

		COR	POR/	ATIO	<u>N</u>							_					
PROJ	ECT:			EAK	ER A	FB F	RFI		JOB	NO.:		_	114	BORING/WELL N			
									LOGG	ED I	BY:	<u>C</u>	Millar	TOTAL DEPTH O	F BOREH	OLE:	40.01
DRILL	JNG C	ONT	RACT	OR:		Tri-S	tate '	Testir	ng				SURFACE ELEV.:		DATUM:		
DRILL	ER'S	NAM	E: J	Tob	20_9	<u>C:-0</u>	w	for	<u>-d</u>					325	DATE:	44	03/95
DRIL													FINISH TIME:	800	DATE:	11/	55/95
								14 k	rov	عو	<u>_</u>		WATER DEPTH:				
BORI HOLE	DIAN	ETER	: 12	1140	, 35	د و	οα' 7%	51 T	3 -4	0-	ه'		DATE:				
													TIME:		ļ		
HAMMER WET.: NA DROPHET: NA SURFACE CONDITIONS: ASPHAL+													BACKFILLED, TIME:		DATE:		
SURF	ACE	COND	mon	s: <i>(</i> -) 50	ha	1+						WEATHER: Clear	; sunny;	bres	24	42°F
									65						DAWII	28	
_		co.		a	Ē				LAB SAMPLE NUMBER		124 X		. ()		7	\	
₹ Z		CHE	2	VER	<u>a</u>			Lon	NO	ь			701/ -	- Sharp	ه کمسستگل	'	CHWIIZE
NTE	17.0	e-IN	RIVI	ECO	Ž	3	ł	MUNSELL COLOR	APLE	巴	5		1, 5				(GAWIIZI
76.	Y.E.	VS /	ES D	ES P	ã.	TUF	E SIL	ISELI	SAN	훋	LITHOLOGY		ME -				•
BAMPLE INTERVAL	Bample type	BLOWS / 6-INCHES	nches driven	NCHES RECOVERED	OVA READING (ppm	MOISTURE	DENSITY	N N	LAB	DEPTH IN FEET	LITHOLOGY		\ <u>c</u> : ski	TCH OF BORING	LOCATIO	N	
		20020000	_	_								94		MATERIAL DESCI			
	A 12-1-1-1-1		2	J. CRAIRCE									Surface	to 10.0	' ~	+ 5	ampled
											H		for Lithol	CO11 5	00	5811	35
	17				_					•	H		for soil de	scription i	- the	+ 1	terral
	\d) .									Н		1. 3	<u> </u>			
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NOTES: Drilled to determine presence or EDITED BYDATE: Hele 1/21/95 absence of contamination in the Sand aquifer.

NOTES:

;12-21-95 ; 4:29PM ;

FIELD LOG OF BORING

WELL NO. MW1128

SHEET 2 OF 3

CORPORATION 0114 BORING NO .: MWIIZ8 JOB NO.: EAKER AFB RFI PROJECT: BLOWS / B-INCHES BAMPLE NUMBER INCHES DRIVEN DEPTH IN FEET **BAMPLE TYPE** OVA (ppm] MOISTURE RECOVERY NTERVAL DENSITY COLOR FLEX. 10,0'-11.0' - Clayer SILT 3FT 3FT 105 ML brownish gray, mothed wi 104R5/3 brn. metties 11.0'- 12.5' - CLAY; some silt; brownish gray wisome 13 5/10 yellowish brize mottles Some root casts worm burrows some rocts still intact: SIt. plastic SICH 12.5-17.0' - CLAY, trace Silt; plastic; brn. mostled wi 10 UR 5/6 yellowish brn. Root casts/ worm burrows Some darker mottles, some intact roots. 17.0' - 25.0' - CLAY, Some Silt, de gray, crumbly texture, vertice root casts wiroots still intacti (some are 4-5 inches in tenoth. Along root casts is relowish red (iron) staining some loye 5/3 brn mottles Product 23 sheren observed in veins 23 from 18.5' to 21.0' Sheen also noted along barrell Strong odor. 0 25,0' - 28.0 - CLAL : Q5 /v above 27 28.0' - TD . SAND. Eg-med arained poorly to led w/ angular qtz; multi colored ACT SX SH SK grains (witt, blk conal); overall delar brownish ences EDITED BY DATE FLECH 11/28/15

13038318208;#21/21



FIELD LOG OF BORING

WELL NO. MW1128

SHEET 3 OF 3

		COR	POR	ATIO	<u>N</u>					_			A414/1/29
	ECT:		EAK			1				JOB	NO.:	0114	BORING NO.: MW1128
INTERVAL	SAMPLE TYPE	BLOWS / 8-INCHES	INCHES DRIVEN	RECOVERY	OVA (ppm)	MOISTURE	DENSITY	COLOR	BAMPLE NUMBER	DEPTH IN FEET	ПТН.		
1		Jan 1	NI WELL							31 52 53 55 56 57 58 59 4c		TD = 40.01	
											<u> </u>		

NOTES:_

EDITED BY/DATE_

Holo No. AP-62

			VISION	INSTALL		,		SHEET)	
	ING LOC		YRD :		111:7		1016 1 1	OF 2 SI	EETS
PROJECT ARILLIA LOCATION	(0)114-	STUAY	I EAKER AFB AR.	10. SIZE	AND TYPE	OF BIT	1014 hit SHOWN (TBM & MSI)	
	5′ fi	ronyi L	1F 62				NATION OF DRILL		
USACE	AGENCY		EP-66-		750 1 40 0F			UNDISTUR	BEO
HOLE NO.	/ A b			BURG	L NO. OF	ES TAKE	H		
NAME OF	()U	EVCO	CD A1 0-		L NUMBER			<u> </u>	
ROGE.	R HU	NTER		15. ELEV	ATION GR		7	COUNTEL	<u>د ل</u>
DIRECTION .			DEG. FROM VERT.	16. DATE	HOLE	İB		3 OCT 95	-
THICKNES					ATION TO				
DEPTH DR			··	1	L CORE R		FOR BORING		*
. TOTAL DÈ	PTH OF H	OLE	10.7		221112	-1 O g	-81N		
LEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIA (Description)	LLS T	% CORE RECOV- ERY	BOX OR SAMPLE NO.	REM/ (Drilling time, wa weathering, etc.	RKS ter loss, dept , if algnificat	h of w
•		-				· · ·	64" ID A	UGER	• • • • • • • • • • • • • • • • • • • •
	\exists								
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i	1 그						+i!! -	No samp	را ف
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			petroleum ad				3-25-	95	
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	7		(,, ,, , , , , , , , , , , , , , , , ,	41/					
İ	=		SILTY LENNICH	ΔY			inserled	INNER	
			damp - moist				1		
	│ , ∃		mollind gray +				1)	mpler	
	4		range.			1.2		2,8	
		•	V. STIFF			6501364	. Rec		٠,
		-	1		1	FIELD T	ì	fell out	o f
	=		medium to stiff petroleum odor			4.5	5	7 12	
	5_		Perioteon paul				1		
	∃	_	_						
			becomes sandy						
			n/fine sand	1				_	a
			and moist to we	T (1	ŀ			5,	
	[-]		petroleum ador	(Yucan)	1		Push pro	be 7.0"	7
] =			6.2	ł	l	Burger		
	▏⊒		SILTY CLAY to claye	ysilt			'		
			V.STIFF TO STI		Ks usl	pressor	Rec.	4.9	
	-, =		Cohesive	, . ,		1			.1-
	' =		moist				made me		
			gray & orange	e brown	n	7.4	from ou of 108'	gered de	11.00
	=		dk brown are	c when		Sumple 1.1			CNIN
			(cut w/ Knife- almost a sheer	7.9	Pricie	1.Ke F	troleum pr	oduct)	
	9_					7.8	olf of		122001
	=		SILT	l.			made fr		•
•] =		DARK GRAY; Wet					קיד ומיט	,
	=		SATURATED, medi	um -		8:1	probe;		
	=		Detro YEUM Odor	<u> </u>		sample	1 100		
	9-		1.			<u> </u>	10.0 on	augor =	=
			SILTY CLAY	/	_9.2	9.0	10.1 on	probe	
	=		STIFF MOIST	1		9.5	.]		
	=	1	GRAY 4 orange bro	711		sample			
	110 =	1	1 7 7 5 60010			9.9	-		
NC FOR	1102/		OUS EDITIONS ARE OBSOLETE.		PROJECT	r ,,,,,	15 15 15 E 15	HOLE	NO.

HOLE NO.

							Hole No. AP-62	_
Dell	ING LOG	DIVI		INSTALL	MPK	-	SHEET Z]
L PROJECT		:	MRD	10. SIZE	AND TYPE	OF BIT	SHOWN (TBM or MSL)	1
Armst 2 LOCATION EAKER	(Coordinate	Stuc	LY EAKER AFB	 -				1
				- CMI	E 751)	NATION OF DRILL	
USACE 4. HOLE NO.	-CEI1P	K-El	P-G6	13. TOT	L NO. OF	OVER- ES TAKEI	DISTURBED UNDISTURBED	
and Hie num			AP-62		AL HUMBE			1
	NON ?	TER			ATION GE	1474	TED ICOMPLETED	-{
VERTIC	AL THE	CLINED_	DEG. FROM				OCT 95 180CT 95	-
7. THICKNES	S OF OVER	BURDEN			AL CORE F		FOR BORING	
S. DEPTH DR				19. SIGN	ATURE OF	INSPECT	lder	
ELEVATION			CLASSIFICATION OF M/			BOX OR SAMPLE NO.	REMARKS (Drilling time, water lose, depth of weathering, etc., if eignificant)	
•		<u></u>	<u> </u>		-	7		ŧ
	=		SILTY CLAY (continued)			10.5		F
			(continued)				- Т R P H	E
	"					10.7		E
	"=						B. O. H'@ 10.7	Ę
	=						11.78 -	Æ
								E
	12							E howard and
	["]	Ì						E
		j				1		E
	▎∄							F
	13.	- 1					1 12 22	E
	E					-	13.33	<u> </u>
	l 크						13.43	E
	=	ĺ						F
ł	14-							E
	l ∃						Taped hole to	. E
							10.3' after auger.	, E
	15				1		Note:	=
	15-						May Have To adjust all depths	E
	13						UP 0.1'	E
	l ∃							=
	16-7				1		Samples 4.2 -4.5 FIELD TRAH	F
1	=						7.4-7.8 (TPH, TRPH, 8.7-9.0 PAH, FIELL	E
	=						8.7-9.0 PAH, FIELD 9.5-9.9 TERPHEE PA). E
							9.5-9.9 (TISPETE PA 10.6-10.8 FIELD TR	ря E
	17-7							E
	=						No water in hole	E
1	寸				1		I an 20 Oct; hole	F
	18						backfilled with	E
	"=						Concrete	E
	=							E
	=							E
j	19=							E
	=							E construction and the
-	-	1						F
	10	1						E

Hole No. AP-67

						Hole No.	T	_
	10.1.00	DIVISION	INSTALL	PK			OF / SHEETS	
PROJECT	40 LUG	MRD	10 5175	ND TYPE	OF BIT]) 4 auber bi	+ 6" inner	н.
ARMSTEI)1)5 VAL	ID. STUCY	11. DAYU	M FOR EL	EVATION)S	HOWN (TBM or MSL)	bul Sanple	4
LOCATION (Coordinates o	t ptwilou)			R'S DESIGN	ATION OF DRILL	<u> </u>	7
DRILLING A	GENCY -EP-GO	S	1	7.50	SCAF		UNDISTURBED	\dashv
HOLE NO. (La ahown on d	rawing title			OVER- ES TAKEN	<u>.i</u>	<u>!</u>	4
HAME OF DE	OVERC	OKE HI-GI			CORE BO		V 10-1-01 V	\dashv
ROGER	, HUIJT	ER	15. ELEV	ATION GR	TAW DHUO	TEO IC	WINTELPO	\dashv
DIRECTION	OF HOLE	NED DEG.	FROM VERT.		19	OCT 95	19 OCT 95	4
			1		P OF HOL			\dashv
. THICKNESS . DEPTH DRI			19. SIGN	ATURE OF	INSPECTO	FOR BORING		긤
. TOTAL DEF		//		11111	2-1-0	1.1.10.1		4
LEVATION			OF MATERIALS	% CORE RECOV- ERY	BOX OR SAMPLE	REMA (Drilling time, wa weathering, etc.	ter lose, depth of	
			1	ery •	1	(1	-
				l i				E
ł	⇉					64" ID		ŀ
	7						LUG ERS	ļ
	7							ļ
	1	NO SAM1	ple thru					١
	\exists	fill ma	Herisl			1		
i	크					NS		
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	3		<u></u>	4				
	3	SALIDY	Fu L					
	=	fine sand				\bullet	,	
	コ	moist, l	00se		3.8		3,8	
	⊿∃	1 ton to b	lack to at	base	3.9	·		
	7 =] wet; some b	alk Incomety 2	.].	3AI IRE	4.2		
	\exists	SILTY	CLAY		}	11.		
		dark green	4,32		45	†		
		7nea-311		-		Auz.	r 5.0	
ł	5-	SILTY	CLAY	İ		1		
]]	gray & or	range brown		5.3		- 5.0	
	l I	stf to vi			SALAPIE			
ł	=	some f. sa	na		5.5	K 4		
1	1, =	moist			SALIFLE	5.8		
1	"	Some iror		1.	1	6.0		
1	=) & become	more praving	pian	7	1		
	=	Ŋ	•			1		
	=	becornes :	Mayer 7.0		6.8	made		
	7二	μ		-	SAMAIU		rements	
	#	Silty	clay		7.0	from 1		
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	=	grain i	wange brown			/		
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1		clay	ey silt	-[8,3		Japed Legi	' o -
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						Concret		

Hole No. AP-63 SHEET DIVISION MKD HSTALLATION 14F.K DRILLING LOG 10. SIZE AND TYPE OF BIT 10 /4 " QUEET 11. DATUM FOR ELEVATION SHOWN (TBM or MSL) 101/4" auger bit ARMSTROLLG - VALIDATION - LAPLY (FB LOCATION (Coordinates or Station) 12. MANUFACTURER'S DESIGNATION OF DRILL
CITE - 750 / SCAPS & 6" INNER by DRILLING AGENCY 13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN CEITRK-ET-6G HOLE NO. (As shown on drawing title and tile number)

DUER CORE 1P-63 14. TOTAL NUMBER CORE BOXES NAME OF DRILLER 15. ELEVATION GROUND WATER NOT EI)COUNTERED ROGER Hunter 18 OCT 95 STARTED . DIRECTION OF HOLE 16. DATE HOLE 18 OCT 95 VERTICAL INCLINED 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERBURDEN 18. TOTAL CORE RECOVERY FOR BORING 19. SIGNATURE OF INSPECTOR B. DEPTH DRILLED INTO ROCK KOTIL111 S. TOTAL DEPTH OF HOLE T CORE BOX OR SAMPLE NO. REMARKS CLASSIFICATION OF MATERIALS (Description) (Drilling time, water loss, depth of weathering, etc., if significant) ELEVATION DEPTH LEGEND Auger to 3.8' SANDY FILL petroleum odor STAFT W/TIP OF PROCE AT 3.77 (3.8')SILTY CLAY PUSH PROBE, AUGER 5.0 dk green gray to Rec 4,Z 5.0 MOIST - wet petroleum odor 5.3 high angle sand layer bir malerial; only apprearance of to, a bottom -SILTY CLAY (petroleum odor throughout sample) gray & orange brown STIFF - VSTIFF MOIST 6.7 \$ SANL 0.07 looks like 0.21 blk at bottom blk may be flat pa ++ cula 16/18 hole niezsured to T SAND 8.7 ; made SILTY CLLY to Iron ho dules Orange brown & gray Moist, STIFF - VISTIFF 7.Z _.7,5 measurements from bottom op 7.9. BAND 0.07 LOOKS LIKE 0.21 7.1 clayey silt 8.71 dk greenish gray wet medium - soft E DH Probe 1.10 below sample Some fine sand No Liquid III HOLE P LID OF DAY, ABOUT 10 backfilled w concrete-

Hole No. AD-103

							Hole Ho. AD 100			
DPILI	ING LO	G DIV	MI'D	INSTALL	ITIOH		SHEET / OF Z SHEETS			
					10. SIZE AND TYPE OF BIT 1014" BIT 4 6" TANGE CELL					
PHST	10116	VALI	D STUDY - LAREK	TII. DATU	M FOR EL	EVATION	SHOWN (IBM or MSL)			
ΛKFV	AF P	ΛР.		12. MANUFACTURER'S DESIGNATION OF DRILL						
DRILLING MKK-	EP-5	6		CME		OVER-	DISTURBED UNDISTURBED			
HOLE NO.	(As shown	on drawin	AD-63	BURC	EN SAMPL	ES TAKE				
HAME OF C	RILLER					OUND WAT				
KOGE DIRECTION	1. 11(7)	NTEP.	·			ST AF	TED COMPLETED			
VERTIC			DEG. FROM VERY	. IE. DATE	HOLE		OCT 15 20 OCT 95			
THICKNES						P OF HOL				
DEPTH DR				19. SIGN	TURE OF	INSPECT	FOR BORING %			
TOTAL DE	PTH OF	HOLE	13,6		1411	27 () ()	ldini			
LEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATER (Description)	IALS	Z CORE RECOV- ERY	BOX OR	REMARKS (Drilling time, water loss, depth of			
4	ь	٠	d		ERY •	NO.	weathering, etc., if significant)	L		
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	4	} .	Block clay	- II.2		4.0		F		
	=	-	SAND	414	Ì	4.4	Kun I	F		
	_=	1	wet w/ product				11.1	F		
	=	1	clayer, cohesive				6" split inner bbl	E		
	= ہ ا	5,0	high angle contact]		Samplel	E		
	"=]	SAND		5.2	5.2		E		
] =	}	yellow stained w/	black	İ	5.3	REC 4.6	F		
	-	5.7		5.7			NEC TIM	F		
	=	1 "-			1			F		
	6-	3	SILTY CLAY AND	SAID				E		
]	high angle to ver	tical	1			E		
	=	‡	(Contact;			ک، ما		F		
	=	‡	clay is gray a ore	ange	1	SAMPLE		F		
	_ =	‡	V. STIFE TO HAR			71.0		F		
	7-	74.	has some root h	is its or	Ì		FIELD TRAN OFF SCALE	F		
	=	-	CLAY becomes COFTER			1	THE TEND IN THE OFF JULLE	F		
	-	7.5.	- /			7.5		E		
	=	3						E		
	8	3					1	E		
	"=]				4 1		E		
	1 =	_				8.4	4 5 5 1 5 7 7 7 1 X 7	þ		
	-	‡	CIV Sund soul				FIELD TR.PH X3 8.6	 =		
		‡	CLY SILT & SAND		1	8.6	one sound one Solf	F		
	9-	7	GREEN GRAY COHESIVE, Some	f sand			ine black clay	F		
	' =	3	MOIST TO WEY			6 4		E		
•		∃	adjacent to fir	7 C		SILT	Run 2	E		
		=	1 1,		1,	SAIL		E		
	1 .	ゴ	SAT SILT: Wadje	cont sa	nja	9.9	1			
	٠ .		place bilese		1	, , ,				

Hole No. AD-63

			,				Hole No	, AD-63			
DD:11	ING I O		VISION	INSTALL				SHEET Z			
. PROJECT	PRILLING LOG MRD PROJECT Armstrono Validation Stury				OF Z SHEETS 10. SIZE AND TYPE OF BIT 11. DATUM FOR ELEVATION SHOWN (TBM or MSL)						
Arms.				-							
EAKE	P AFE		R		FACTURE E 750		NATION OF DRIL				
3. DRILLING CE	MRY	-EP	-66		AL NO. OF		DISTURBED	UNDISTURBED	1		
4. HOLE NO. and tile num		n on drawn FFSE		ļ	AL NUMBE				1		
S. NAME OF E					VATION GE]		
6. DIRECTIO	N OF HOL	.E		16. DAT	E HOLE		OUT 95	20 OCT 95			
VERTIC	CAL D	INCLINED	DEG. FROM VERT.	17. ELE	VATION TO]		
7. THICKNES							FOR BORING	*	-		
a. DEPTH DR 9. TOTAL DE				19. SIGN			99 Juni		1		
ELEVATION		LEGEND	CLASSIFICATION OF MATERIA (Description)	ALS		BOX OR SAMPLE NO.	RE (Dritting time, s weathering, e	MARKS mater loss, depth of IC., it significant			
•	106	•	(AS ABOVE)		10.1		Run 1	>	F		
	=] _	STIFF CLAY SILTY, Iron nod (s	mul)	''''				E		
	_	2	sat > wet, Haray green	d oran	e.0.6		RAN.		F		
	=	2 7 -	SAND + SILTY CL				REC.	5	F		
	<i>πΞ</i>	ב תר	sand & Cloy are side	by sid	ę.	1			E		
	=	3 5		•					þ		
	_	5	SAND IS STOLLED W/ 612	ATURAT	ED	1 ,			Ė		
	=	HOOT HOOT	Predominanty green day	1. som	oran	ge bvo	מין		E		
	1,2 =	ქ. ს.			11.9	120			þ		
	12-	2 3	FAT CLAY FIN	E SAIN	/				E		
	=	‡ ۾ ا	WET, STIFF STICKLY Some SIH			12.4	}		þ		
	=	3 7 25 L	Some s'ilt gray w/orangi	e brown	,				E		
	_ =	3 3	petroleum ode	7					E		
	13-	2 6	black hair like	OVYZNI	dor ion	lmotte	r		ţ		
	-=	CLAY	Iron nodules (•				13.6	ŀ		
			FINE SAND - S. Petrokum odo		<u> </u>	 					
	=] "	turns green w	hen /	//			B.O.H	İ		
	-	‡	dry; loose	<u>-, /,</u>	/\				-		
	=	Ξ.	adjacent to	CAL	` 				ļ		
]	-	=	clay becomes more orange	6000			N		Į		
1	:	1	wi/depth]			IND TURNS	۱		
	-	3	11				GREENIS				
	=	#					drying ;	, can see			
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		3				1	angle i	sathways.			
1	_	‡					'''' '	1			
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[=	=					Free pr	oduct			
1		7					Free pr en-tred	hole -			
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1		#					day.	Hole			
1		3					1 307	11-1 1.114/2			
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1		Ξ					Fuelsa	imple sent			
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Hole No. AD-68

AD 68 11. DATE 12. MANU (. 1) 13. TOTA BURD 14. TOTA 15. ELEV 16. DATE 17. ELEV	AND TYPE OF MM FOR ELEV. IFACTURER'S IFACT	ORE BOXES IND WATER NOT ENC STARTED IC OF HOLE COVERY FOR BORING INDEX OX OR REMA NO. (Drilling time, etc. weathering, etc.	COUNTERED OMPLETED 20 ACT 95.	
EAKER- AFB 10. SIZE 11. DATU C. (1) AD 68 14. TOTA 15. ELEV DEG. FROM VERT. 17. ELEV 18. TOTA 19. SIGN,	IN FOR ELEV. IFACTURER'S IFAC	EDESIGNATION OF DRILL W/ (91/4 "TD H1) VER- DISTURBED TAKEN CORE BOXES IND WATER NOT ENC STARTED 10 OF HOLE COVERY FOR BORING SPECTOR 11/1/1 DOX OR REMA NO. (Drilling time, weathering, etc.)	COUNTERED OMPLETED 20 ACT 95.	
12. MANU (C. 1) 13. TOTA BURD 14. TOTA 15. ELEV 16. DATE 17. ELEV 18. TOTA 19. SIGN	L NO. OF OVDEN SAMPLES AL NUMBER C VATION GROU E HOLE VATION TOP AL CORE REC ATURE OF IN CREATER ATURE OF IN AL LORE LEFT ATURE OF IN AL LORE ATURE OF IN AL LORE ATURE OF IN AL LORE ATURE OF IN ATURE OF IN ATURE OF IN ATURE OF IN ATURE OF IN ATURE OF IN ATURE OF IN	OF HOLE COVERY FOR BORING COVE	COUNTENSED COUNTENSED OMPLETED 20 ACT 95.	
13. TOTA BURD 14. TOTA 15. ELEV DEG. FROM VERT. 16. DATE 17. ELEV 18. TOTA 19. SIGN	AL NO. OF OVER SAMPLES AL HUMBER C VATION GROU E HOLE VATION TOP (AL CORE REC ATURE OF IN	TAKEN DISTURBED TAKEN DISTURBED TO COLUMN TENCE TO COL	COUNTENSED COUNTENSED OMPLETED 20 ACT 95.	
AD 68 14. TOTA 15. ELEV 16. DATE 17. ELEV 18. TOTA 19. SIGN	AL NUMBER C VATION GROU E HOLE VATION TOP O AL CORE REC ATURE OF IN	TAKEN CORE BOXES IND WATER NOT ENC STARTED OF HOLE COVERY FOR BORING SPECTOR ON OR COVERY FOR BORING COVERY FOR BORING COVERY FOR BORING COVERY FOR BORING COVERY FOR BORING COVERY FOR BORING COVERY FOR BORING COVERY FOR BORING COVERY FOR BORING COVERY FOR BORING COVERY FOR BORING COVERY FOR BORING COVERY FOR BORING COVERY FOR BORING COVERY FOR BORING COVERY FOR BORING COVERY FOR BORING COVERY FOR BORING COVERY FOR BORING COVERY FOR BOXEN COVERY FOR	OMPLETED 20 NCT 95.	
15. ELEV 16. DATE 17. ELEV 18. TOTA 19. SIGN	VATION GROU E HOLE VATION TOP (AL CORE REC ATURE OF IN	STARTED CONTROL CONTRO	OMPLETED 20 NCT 95.	
16. DATE 17. ELEV 18. TOT 19. SIGN	E HOLE VATION TOP O AL CORE REC AYURE OF IN	OF HOLE COVERY FOR BORING ISPECTOR OX OR OX OR (Dellling time, etc. weathering, etc.	OMPLETED 20 NCT 95.	
17. ELEV 18. TOT / 19. SIGN	AL CORE REC	OF HOLE COVERY FOR BORING ISPECTOR ON OR	X	
19. SIGN.	ATURE OF IN	SPECTOR JAN DA OR REMA MPLE (Drilling time, wall NO. weathering, etc.	7	
		OX OR REMA MPLE (Dellting time, wai NO. weathering, etc.		
ASSIFICATION OF MATERIALS (Description)	RECOV- ERY	OX OR REM/ IMPLE (Drilling time, was NO. weathering, etc.		
		1	ter loss, depth of ., If significant)	_
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(Fill)			E	–
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SANDY CLAY 1			-	-
petroleum odon i		1	31. E	<u>:</u>
dk beown to blk	3.7	3.4 bil 155		<u>.</u>
W/wet surfaces		11 1A 1 1/6 C A 1	<u></u>	<u>-</u>
		719		-
comes mottled w/ overse	را ا	A.S	E	<u>.</u>
come olesher (lighter	"in colo	n) and	F	<u>.</u>
STIFF, Crumbly	-	HINV / I ICA (<u> </u>	-
SILTY CLAY TO CLY SILT	-	İ	E	<u> </u>
gray = orange brown			F	_
noist w/wet surfaces	5.4	5.5 - 6.0 AI	HOLYTICAL SAIDIE	-
crumbly structure	y} ├-		₂)	= .
W/ Ane's and	'l l	SAFIFLE	. [<u> </u>
SILT W/ CLAY		• 11	F	=
medium wet to si	altacad	: کاما	E	<u> </u>
some iron staining	^	· •	E	
		7.2	ļ	=
SILT, Clayey	1 7	GEDTECH	E	<u>-</u>
	<u>.</u>	7.5-8.0 AI	121. YTCKL SAMPLE	-
Silt chavey - clay	ws	1.6	<u> </u>	_
STIFF, becomes darker arau			F	=
omes sandy			<u> </u>	- .
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	}			=
	PROJECT	MICHINEA	HOLE NO.	_
	comes mottled w/ orane roun = cyceyer (lighter STIFF, crumbly SILTY CLAY TO CLY SILT fray = orange brown medium moist w/wet surfaces white root hairs: Crumbly structure w/ fine sand SILT W/ CLAY some fine sand, di medium wet to s ome iron staining nottled w/increase in clay To SILT, clayer Groy, sdy, med, moist Withe white root ha SILT, clayer Groy, sdy, med, moist SILT, clayer Let Y, sdy, med, moist	Sandy CLAY Crumbly texture petrole um odor dk baown to blk VETIFF TO ETIFF, moist Numet surfaces comes mothled w/ orange rown o greyer (lighter in colo SITFE, crumbly Solty CLAY TO CLY SILT tray - orange brown medium moist w/wet surfaces white root hairs: Crumbly structure W/ Fine sand, dk gray Medium wet to sa some ifort staining mothled w/increase in clay SILT, clayery mothled w/increase in clay SILT, clayery wet SILT, clayery wet Silt, clayery wet Silt, clayery wet Silt, clayery orner sandy orner sandy	Sandy Clay Crumbly texture petrole um odor dk baown to blk vitiff to etilf, maich w/wet surfaces comes mothled w/ orange comes mothled w/ orange comes mothled w/ orange comes mothled w/ orange comes mothled w/ orange comes mothled w/ orange comes mothled w/ orange comes mothled w/ orange comes mothled w/ orange comes mothled w/ orange soluty clay to cry silt comes to cry silt comedium modium	Sandy Clay Crombly texture petrole um odor dk beaun to blk vitiff to etiff, mount w/met surfaces Simme grover (lighter in color) and strip clay to cry Sitt fray - orange brown medium medium wet surfaces white root hairs Sitt w/clay to cay Sitt w/clay to cay Sitt w/clay Some fine sand, dk gray medium wet to sa white root hairs Sitt w/clay Some fine sand, dk gray medium wet to sa some iron staining notice In clay Sitt clayer Sitt clayer Sitt clayer Sitt clayer Sitt clayer Sitt clayer Sitt clayer Sitt clayer Sitt clayer Some fine sand The some iron staining motive white root haws Sitt clayer Sitt clayer Sitt clayer Some fine sand The some iron staining motive white root haws Sitt clayer Sitt clayer Sitt clayer Some fine sand The some iron staining The some iron staini

Hole No. AP-67

							Hole No.	AP-69	
DDU I	ING LOG		ISION MRE	INSTALLA	TION M	PK		SHEET /	
1. PROJECT			EARLY AUT. AR.	10. SIZE A	ND TYPE	OF BIT	014 auger br	F / 10" inner bbl	
2. LOCATION	(Coordinat	on or Stat	EAKER AIE, AF.	12 MANU	FACTURE	R'S/DESIGN	ATION OF DRILL		
3. DRILLING	AGENCY	. 10 1/ E	P-61s	1 Cr	IE 75 () / SCA	PS IDISTURBED	UNDISTURBED	
A HOLE NO.	(As shown	on drawle	atitle A.C. 17	13. TOTA	L NO. OF EN SAMPL	OVER- .ES TAKEN	<u> </u>		
						CORE BO		KOUITER.ED	
& DIRECTIO	06ex. 11	UNITE	γ.	 		ISTAR	TED IC	OMPLETED	1
VERTI			DEG. FROM VERT.	16. DATE			<u>~ · · · · · · · · · · · · · · · · · · ·</u>	19 0.7 95	ł
7. THICKNES	S OF OVE	RBURDEN				P OF HOL	FOR BORING	*	1
8. DEPTH DE			.0.1			INSPECTO			1
9. TOTAL DE			CLASSIFICATION OF MATERI	_ 		BOX OR SAMPLE NO.	BEM/	ARKS	1
ELEVATION	DEPTH	LEGEND	(Description)		ERY	NO.	(Drilling time, we weathering, etc.		<u> </u>
	3 4 5 7 7 9 9	c	SAND DAMD, FINE, GRAY to FILL SILTY CLAY STIFF, DAMP DARY GRAY CLAYEY SILT MEDIUM, COLAY MOIST LEGRAY + OVANCE SOME IRNIJ STA FIND STAIN WITH STAIN MOIST LEGRAY + OVANCE SOME IRNIJ STAIN WITH STAIN MOIST LEGRAY + OVANCE SOME IRNIJ STAIN WITH STAIN MOIST STIFF - V.ST SILTY CLAY STIFF; 1101ST GRAY CLAY COMESIVE, GREENISH DECOMES SATURATED, DECOMES SATURATED, DECOMES SATURATED, DECOMES SATURATED,	2.9 A.3.4 to more 4.3 PA/ 5.5 PA/ 5.5 T.0 PROVING Gray Gray	+		LO OCT; It to ped a ped	Ape to 4.8 From 1.9 Proble to pushed poshe	
	10		В.О.Н			FIELD TEH+ 9.8	Profes		E

PROJECT

APPENDIX B - 1B

WELL INSTALLATION LOGS

BX SHOPPETTE

Source: Halliburton NUS 1992 and 1995.



FIELD WELL COMPLETION FORM TWILD!	CHRISTY BOX
NAME: EAKER AFB BX SHOPETTE	LOCKING STEEL COVER
	STEEL CONDUCTOR
HUMBER: 31498 MANAGER: GVG	CASING
15.5 PT. BFIL	
NAME: TW 1101 12/11/91	BOREHOLE
COMPANY: A.W. POOL	0 to 30 feet
INCH HOLLOW STEM AUGER V. BARAZZA	BENTONITE CEMENT
INCH ROTARY WASH	8 SACK CEMENT SAND
SALLONS OF WATER USED DURING DRILLING: NONE GALLONS	
METHOD OF DECONTAMINATION PRESSURE STEAM	700.00
	TOP OF CASING AT O · 2 FEET ABOVE AT
DEVELOPMENT SEE WELL DEVELOPMENT PORM	SELON PHOOND LEVEL 1
DEVELOPMENT:	BOREHOLE
EGAN DATE: TIME:	30 0:0 30 leer
GRM FROM TO DATE:	Wa INCH DIAMETER
TIME: DATE:	SCHEDULE 40 PVC BLANK CASING
GPM FROM TO DATE:	0.2 to 15.21eer
GPM FROM TO DATE:	SENTONITE-CEMENT
OTAL WATER REMOVED	B-SACK CEMENT-SAND
DESCRIPTION	11 60.5 teer
OF TURBIDITY CLEAR SLIGHTLY CLOUDY	BENTONITE PELLET
MOD. TURBID VERY MUDDY	12.5:011
NATER:	LULGRAPH SILICA 20/
GROUND SURFACE TANK TRUCK TO: STORM SEWERS STORAGE TANK	SAND PACK
DRUMS DOTHER	30 10 12.5 1001
SEPTH TO WATER FEET FEET	SLOTTED 1 0.006
MATERIALS USED	man + SCREEN
	15.2 :0 25.2 ieet
3 100# SACKS OF LOLDRADO SILICA ZOLYO SAND	2 INCH DIAMETER
SACKS OFCEMENT	BLANK SILT TRAP 25.2 to 27.2 test
~ 20 GALLONS OF GROUT USED (PRETTAND TYPE IT W/BENTOWITE)	
SACKS OF POWDERED BENTONITE	BOTTOM WELL CAP
50 POUNDS OF BENTONITE PELLETS	HOLE CLEANED OUT TO
15 FEET OF 2 INCH PVC BLANK CASING	30 1981
FEET OF TINCH PUC SLOTTED SCREEN	BOTTOM OF BOREHOLE
TARO COMO COMO CONTROL	*No
YARD CEMENT-SAND (REDI-MIX) USED	ACCUTIONAL INFORMATION
CONCRETE PUMPER USED? NO TYES	DOTE: MATERIALS WERE
NAME	
WELL COVER USED: DOCKING STEEL COVER	NOT MEASURED BETROKE
ACHRISTY BOX	GOING IN WELL T'S



FIELD WELL COMPLETIC	N FORM		E CHRISTY BOX	
100 CO 1/CO 004	D.V		LOCKING STEEL	-
NAME: EAKER AAS	PROJECT MAHAGER:	Gil-	TINCH DIAM STEEL CONDUCT: CASING	
LOGGED JSB	EDITED	bFU		e t
WELL		DATE: /2-//-9/	BOREHOLE	ETER
DRILLING A WPOOL		112 11 11		e t
FOUIPMENT: \ / U.	OLLOW STEM AU	IGER V. BARAZZA	BENTONITE-CEM	ENT
<u> </u>	OTARY WASH	HOURS DRILLED: 66	B SACK CEMENT.	SAND
GALLONS OF WATER	JONE	GALLONS	101	e t
METHOD OF DECONTAMINATION		STEAM	TOP OF CASING	AT
DEVELOPMENT SEE WELL			SELOW GROUND	VE AT
METHOD OF DEVELOPMENT:			6 1/4 INCH DIAM	
DEVELOPMENT BEGAN DATE:	TIME:		BOREHOLE C :0 3C	eet.
YIELD: TIME:	то	DATE:	Z INCH DIAM	METE
YIELD: TIME:	то	DATE:	BLANK CASING	-
YIELD: TIME:	то /	DATE:	Q./ 10/2.4/ ft	
YIELD: TIME:	TO	DATE:	SEAL OR	
TOTAL WATER REMOVED DURING DEVELOPMENT:		GALLONS	B-SACK CEMENT-	SANE
DESCRIPTION CLEAR	[SLIGHTLY CLOUDY	BENTONITE PELI	ter LCT
AT END OF DEVELOPMENT: MOD.	rursio . [VERY MUDDY	SEAL	
DOOR OF WATER:			9:0:11-16	
WATER GROUNDS		ANK TRUCK	SAND PACK	UWEE
TO: STORM SET DRUMS		TORAGE TANK THER	1/ 10 2/27 ft	
DEPTH TO WATER		FEET	SLOTTED 1 0.0	26
MATERIALS USED			124 :0 326 in	e vt
) = SII.	1	•	2 INCH DIAM	ME TE
3.5 SACKS OF SILICI		SAND	SCHEDULE 40 PV BLANK SILT TRA	AP
SACKS OF SACKS OF		CEMENT		ee t
SACKS OF POWDER	-	410 5 ((C 312 15) 150 15	BOTTOM WELL C.	AP
56 POUNDS OF BENTO			HOLE CLEANED	ОПТ
12,4 FEET OF 2 INC		SING	<u>30</u> 1981	
16.2 FEETOF 2 INC.		ENEEN -	BOTTOM OF BOR	ЕНО
The state of the s				
YARIO PEMENT SO	Y MEDIMINI D	HDERED	NOT TO SCALE	
YARD ³ CEMENT-SA	ND (REDI-MIX) U	SED	ADDITIONAL INFORMATION:	
CONCRETE PUMPER USED? (NO DYES		Buchela cover is to 3	,
NAME			police to suffer call	
WELL COVER USED: LOCKIN				



FIELD WELL COMPLETIC	MITORM				CHRISTY BOX
NAME: EAKER AFB	BX		П		LOCKING STEEL COVE
NUMBER: 3K98		=V6-	41-5		STEEL CONDUCTOR
iogen 15B	EDITED	=N			CASINGtofeet
VELL TWILDS	100. D7	DATE:			INCH DIAMETER
ORILLING AW POOL		12/11/91			BOREHOLE
EQUIPMENT:		DRILLER:			BENTONITE-CEMENT
	OLLOW STEM AUGE: OTARY WASH	HOURE			SEAL OR 8-SACK CEMENT-SAND
TALLOWS OF WATER		ORILLED:	1.5	1 1 1	SEAL .
JSED DURING ORILLING: METHOD OF DECONTAMINATION PRIOR TO DRILLING:	NONE	GALLONS			
			1		TOP OF CASING AT 21 FEET ABOVE AT
48THOD OF	L DEVELOPMEN	IT POIRM			GELON GROUND LEVE
DEVELOPMENT:				.	BOREHOLE
HEGAN DATE:	TIME:	DATE:			O :0 30 1 eer
GPM FROM	TO	DATE:		•	SCHEDULE 40 PVC
GRM FROM	то	DATE:			BLANK CASING
GPM FROM	то /	DATE			- SENTONITE-CEMENT
GPM FROM	то			-	SEAL OR 8-SACK CEMENT-SAND
OTAL WATER REMOVED URING DEVELOPMENT:		GALLONS			SEALfeer
ESCRIPTION P TURBIDITY	C SI	LIGHTLY CLOUDY			BENTONITE PELLET
EVELOPMENT: MOD.	TURBIO UV	ERY MUDDY			SEAL <u>j/</u> :0 /3 /eet
DOR OF ATER:	*.				[NAWE] [NUMBER
DISCHARGED GROUND S		TRUCK AGE TANK		\equiv	SAND PACK
☐ ORUMS	Оотне	`.			- INCH DIAMETE
DEPTH TO WATER AFTER DEVELOPMENT:		FEET		\equiv	SLOTTED 1 0-010
MATERIALS USED				\equiv	15:/ :0 35:/ inet
3.5 SACKS OF 51/1	ca Grade	SAND		-	INCH DIAMETE
SACKS OF					BLANK SILT TRAP
GALLONS OF GROU					
SACKS OF POWDER	ED BENTONITE		,		BOTTOM WELL CAP
POUNDS OF BENTO					HOLE CLEANED OUT
INC					<u>30</u> 1-11
10 FEET OF INC	HPVC SLOTTED SCR	EEN			SOTTOM OF BOREHOU
Comment of the Commen					
YARU GEMENT-SA	· • · · · · · · · · · · · · · · · · · ·	= .			
TAND CEMENT-SA	MU (REDI-MIX) USE	י			INFORMATION:
CONCRETE PLINSED LISED?	CNO C				
	□NO □YES		ωει	LL ABA	NDOWED 1/8/72
CONCRETE PUMPER USED? NAME			<u>ωει</u>	LL ABA	NDO.368 1/8/72



COCKING STELL OF B	FIELD WELL COMPLE	TION FORM		SCHRISTY BOX	}
THE CONCRETE PUMPER STATE CONCRETE PUMPER STATE CONCRETE PUMPER USED TO STATE STATE STATE CONCRETE PUMPER STATE CONCRETE PUMPER USED TO STATE ST	100			LOCKING STEEL CO	VEP
CALLONS OF SHIELD ONLY TO DATE: VIELD: OPM FROM TO DATE: VIELD: OPM	108		GYG	STEEL CONDUCTOR	
WHILE WILD UP DATE BORENDY AWAY POOL EQUIPMENT AWARD POOL EQUIPMENT AWARD POOL EQUIPMENT AWARD POOL EQUIPMENT AWARD POOL CALLONS INCH ROTARY WASH CALLONS CAL	LOGGED				!
CONCRETE PUMPER USED POLITIONS CONTRIBUTION CONTRIBUTIO	W 24 1	104:		INCH DIAME	TER !
CONCRETE PUMPER USED) CONTRACTOR OF SACKS OF SIFICA Grade SACKS CEMENT SALORS CONTRACTOR OF SOME SENTONITE PELLETS CONCRETE PUMPER USED) CONCRETE PUMPER USE			12-11-91		
SEAL OR INCH ROTARY WASH ORILLED	COMPANY: A.W. POOL				
CALLONS TOP OF CASING AT TOP OF CASING AT OF ETH ABOVE A DEVELOPMENT SEC DEVELOPMENT FORM DEVELOPMENT SEC DEVELOPMENT TIME: TOP OF CASING AT OF ETH ABOVE A GET OF MELLINE: TOP OF CASING AT OF ETH ABOVE A GET OF MELLINE: TOP OF CASING AT OF ETH ABOVE A GET OF MELLINE: TOP OF CASING AT OF ETH ABOVE A GET OF THE BOREHOLE SOREHOLE SOREHOLE DEVELOPMENT TIME: TO DATE: TIME: TO DATE: TIME: TO DATE: TIME: TO DATE: TO D	₩ EVY INC		HOURS	SEAL OR BISACK CEMENTISA	
DEVELOPMENT SEE DEVELOPMENT FORM DEVELOPMENT SEE DEVELOPMENT FORM DEVELOPMENT SEE DEVELOPMENT FORM DEVELOPMENT SEE DEVELOPMENT FORM DEVELOPMENT SEE DEVELOPMENT FORM DEVELOPMENT SEE DEVELOPMENT FORM DEVELOPMENT SEE DEVELOPMENT FORM DEVELOPMENT SEE DEVELOPMENT FORM DEVELOPMENT SEE DEVELOPMENT FORM THE STATE SEE DEVELOPMENT FORM THE STATE SEE DEVELOPMENT SEE SORE SORE SORE SORE SORE SORE SORE	GALLONS OF WATER	naal		toleet	
DEVELOPMENT SEE DEVELOPMENT FORM RETHOD OF OVELOPMENT: TIME: OVERTIFIED OF FROM TO DATE: VIELD: OF FROM TO DATE: VIELD: OF FROM TO DATE: OF FROM TO DATE: OF FROM TO DATE: DATE: OF FROM TO DATE: DATE: SCHODLUE 40 PVC BLANK CASING OF FROM TO DATE: DATE: SELONS OF FROM TO DATE: DATE: SELONS OF FROM TO DATE: DATE: SELONS OF FROM TO DATE: DATE: SELONS OF FROM TO DATE: DATE: SELONS OF FROM TO DATE: DATE: SELONS OF FROM TO DATE: DATE: SELONS OF FROM TO DATE: SELONS OF FROM TO DATE: DATE: SELONS OF FROM TO DATE: DATE: SELONS OF FROM TO DATE: DATE: SELONS OF SELONS OF FROM TO DATE: DATE: SELONS OF SELONS	METHOD OF DECONTAMINA	TION			
SCHORD TO SCHOOL TO SEAL OF SINCE GROUND SURFACE TANK TRUCK TOTAL WATER GROUND SURFACE TANK TRUCK SACKS OF SACKS OF SINCE GROUN SURFACE TANK TRUCK DEPTH TO WATER AFFECT SACKS OF SINCE GROUND THE SACKS OF SACKS OF SOFT SACKS OF SACKS O	DEVELOPMENT SEE DE			BELOW GROUND L	EVE
DEVELOPMENT VIELD GRM FROM TO DATE: C. D. 3.0 level SCARDOVE SCHOOL GRAW FROM TO DATE: SCHOOL GRAW SCHOOL GRAW SCHOOL GRAW FROM TO DATE: SCHOOL GRAW SCHOOL				BOREHOLE	TER
TIRCH DIAMETE VIELD: GPM FROM TO DATE: VIELD: GPM FROM TO DATE: VIELD: GPM FROM TO DATE: VIELD: GPM FROM TO DATE: VIELD: GPM FROM TO DATE: SENTONITE-CEMENT SEAL OR SENTONITE-CEMENT SEAL OR SEACK CEMENT-SANI SEAL OR SEACK CEMENT-SANI SEAL OR SEACK CEMENT-SANI SEAL OR SEACK CEMENT-SANI SEAL OR SEACK CEMENT-SANI SEAL OR SEACK CEMENT-SANI SEAL OR SEACK CEMENT-SANI SEAL OR SEACK CEMENT-SANI SEAL OR SEACK CEMENT-SANI SEAL OR SEACK CEMENT-SANI SEAL OR SEACK CEMENT-SEAL I O 10 10 10 10 10 10 10 10 10 10 10 10 10		TIME:		1 1 1	:
THELD: GPM FRQM TO DATE: VIELD: GPM FRQM TO DATE: GPM FRQM TO DATE: GPM FRQM TO DATE: GPM FROM TO DATE: FROM TO DATE: GPM FROM TO DATE: GPM FROM TO DATE: GPM FROM TO DATE: GENTONITE CEMENT SEAL OR SEAL OR SEAL OR SEAL OR SEAL OR SEAL OR GENTONITE PELLET SEAL OR GENTONITE PELLET SEAL OR GENTONITE PELLET SEAL OR GENTONITE PELLET SEAL OR GENTONITE PELLET SEAL OR GENTONITE PELLET SEAL OR GENTONITE PELLET SEAL OR GENTONITE PELLET SEAL OR GENTONITE PELLET SEAL OR GENTONITE PELLET SEAL OR GENTONITE PELLET SEAL OR GENTONITE OF GENT		TO	DATE:	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
VIELD: GPM FROM TO DATE: VIELD: GPM FROM TO DATE: VIELD: GPM FROM TO DATE: SENTINITE-CEMENT SEAL OR BENTONITE-CEMENT SEAL OR BESTONITE-CEMENT SEAL OR BESTONITE-CEMENT SEAL OR BESTONITE-CEMENT SEAL OR BESTONITE-CEMENT SEAL OR BESTONITE-CEMENT SEAL OR SEAL TO 10 10 10 10 10 10 10 10 10 10 10 10 10	YIELD: TIME:		DATE:	BLANK CASING	
VIELDI COM FROM TO DATE: SERTONITE CEMENT SEAL OR B.SACK CEMENTSANISEAL JO: 0 0.5 1est OESCRIPTION OF TURBIDITY OESCRIPTION OF TURBIDITY OESCRIPTION OF TURBIDITY OESCRIPTION OF TURBIDITY OESCRIPTION OF TURBIDITY OESCRIPTION OF TURBIDITY OESCRIPTION OF TURBIDITY OESCRIPTION OF TURBIDITY OESCRIPTION OF TURBIDITY OESCRIPTION OESCRIPT	VIELD: TIME!		DATE	0.1 to 14.1 feet	1
CONCRETE PUMPER USED? CALLONS	VIELD: TIME:		DAYE:	SEAL OR	
SLIGHTLY CLOUDY SENTONITE PELLET SEAL 10 :0 12 SEAL 10	TOTAL WATER REMOVED		GALLONS	SEAL	
DOWN OF SEAL 10 10 10 12 10 12 10 12 10 10 10 10 10 10 10 10 10 10 10 10 10	OFSCRIPTION	548		5555	
MATER ORDER OF ORDER OF SINCE STORAGE TANK DISTORM SEWERS STORAGE TANK DEPTH TO WATER OF STO	AT END OF	\	••	SEAL	
WATER OF POWDERED BENTONITE SACKS OF POWDERED BENTONITE SACKS OF POWDERED BENTONITE SACKS OF POWDERED BENTONITE SACKS OF POWDERED BENTONITE SACKS OF SINCH PVC BLANK CASING 12 10 20 1001 SACKS OF POWDERED SCREEN 14 FEET OF PINCH PVC BLANK CASING 15 1001 16 1001 17 FEET OF POWDERED SCREEN 17 1001 18 1001 19 1001 19 1001 10 1001	ODOROF	38. 10.18.8	VERT MODE!	10:012 'est	٠ /
STORM SEWERS STORAGE TANK 12 10 30 1001 1001 1001		NO SUBFACE TO	UK TÖRICK	name! Inum	2/40
MATERIALS USED MATERIALS USED DEPTH TO WATER DEVELOPMENT: MATERIALS USED DISCREEN SACKS OF SINCA GRADE SAND SACKS OF CEMENT SACKS OF CEMENT SACKS OF POWDERED BENTONITE SACKS OF POWDERED BENTONITE SO POUNDS OF BENTONITE PELLETS HOLE CLEANED OUT 1// FEET OF INCH PVC BLANK CASING 1// FEET OF INCH PVC SLOTTED SCREEN THOSE SACKS OF POWDERED SCREEN ADDITIONAL INFORMATION: CONCRETE PUMPER USED? NO DYES SCHEDUL 40 PVC SCHEEN SINCH DIAM SILL TRAP AND SCHEDULE 40 PVC BLANK SILT	DISCHARGED			12 10 30 100	t
MATERIALS USED 15		з 🗆 Отн	1ER	2 INCH DIAME	TEA
MATERIALS USED			FEET		
SACKS OF STREET OF SAND SACKS OF CEMENT SACKS OF CEMENT GALLONS OF GROUT USED (PORTIAND TYPE IT WIGHTONITE) SACKS OF POWDERED BENTONITE SO POUNDS OF BENTONITE PELLETS HOLE CLEANED OUT 1/1 FEET OF INCH PVC BLANK CASING 1/2 FEET OF INCH PVC SLOTTED SCREEN WOTTO SCREEN BOTTOM WELL CAP BOTTOM OF BOREHO ROTTOM OF BOREHO WARD CEMENT-SAND (REDI-MIX) USED ADDITIONAL INFORMATION: CONCRETE PUMPER USED? NO DYES	MATERIALS USED				t
SACKS OF CEMENT GALLONS OF GROUT USED (PORTAND TYPE IT W/BENTENITE) SACKS OF POWDERED BENTONITE SO POUNDS OF BENTONITE PELLETS 17 FEET OF INCH PVC BLANK CASING 10 FEET OF INCH PVC BLANK CASING 10 FEET OF INCH PVC SLOTTED SCREEN TARP 291 to 291 feet BOTTOM WELL CAP HOLE CLEANED OUT 30 feet 60TTOM OF BOREHO 11 NOT TO 3C YARD CEMENT-SAND (REDI-MIX) USED ADDITIONAL INFORMATION:	7.5	ilies Corde	•	3 INCH DIAME	TER
GALLONS OF GROUT USED (PORTIAND TYPE I W/GENTONITE) SACKS OF POWDERED BENTONITE 50 POUNDS OF BENTONITE PELLETS 14 FEET OF 2 INCH PVC BLANK CASING 10 FEET OF 2 INCH PVC SLOTTED SCREEN 14 OF THE TOTAL OF BOREHO THE				BLANK SILT TRAP)
SACKS OF POWDERED BENTONITE 50 POUNDS OF BENTONITE PELLETS 14 FEET OF INCH PVC BLANK CASING 10 FEET OF INCH PVC SLOTTED SCREEN				0/1 to 261/ fee	t
FEET OF PINCH PVC BLANK CASING 10 FEET OF INCH PVC SLOTTED SCREEN 10 FEET OF INCH PVC SLOTTED SCREEN 10 FEET OF INCH PVC SLOTTED SCREEN 10 FEET OF AND INCH PVC SLOTTED SCREEN 10 FEET OF AND INCH PVC SLOTTED SCREEN 10 FEET OF AND INCH PVC SLOTTED SCREEN 10 FEET OF AND INCH PVC BLANK CASING			10 TALE I MIGENLEVILE)		,
FEET OF INCH PVC BLANK CASING					17 7
	_		ING		
TARD CEMENT-SAND (REDI-MIX) ORDERED YARD CEMENT-SAND (REDI-MIX) USED CONCRETE PUMPER USED? NO DYES				BOTTOM OF BORE	ior
	(1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -			<i>51</i> /	
		SANGEREUGHIX) OR	DERED	NOTTOSCAL	=
CONCRETE PUMPER USED? NO TYES			•	ADDITIONAL INFORMATION	
NAME		\		ADDITIONAL INFORMATION.	
	NAME				
WELL COVER USED: ELOCKING STEEL COVER	/				
CHRISTY BOX					



FIELD WELL COMPLETION	FORM	☐ CHRISTY BOX
108	•	LOCKING STEEL COVER
NAME: EAKER AFR JOB NUMBER: 3K98	PROJECT MANAGER: GVG	INCH DIAMETER STEEL CONDUCTOR CASING
LOGGED	EDITED BEN /JSB	
WELL BFN	QATE:	INCH DIAMETER
NAME: EIITWOS	12/13/91	BOREHOLE
COMPANY: Pol D	rilling	to
EQUIPMENT: 644 INCH HOLI	LOW STEM AUGER V. BUNAZZA	BENTONITE CEMENT SEAL OR
INCH ROTA	HOURS	8-SACK CEMENT-SAND
GALLONS OF WATER		
METHOD OF DECONTAMINATION	E GALLONS	
	leaned	TOP OF CASING AT
DEVELOPMENT SEE LOGBO	OF; WELL CONTAINS PREE	BELOW GROUND LEVEL
METHOD OF PRODUCT	was not developed	6 1/ INCH DIAMETER
DEVELOPMENT BEGAN DATE:	TIME:	BOREHOLE O :0 25 teet
YIELD: TIME:	DATE:	Z INCH DIAMETER
GPM FROM	TO DATE:	- SCHEDULE 40 PVC
	TO DATE:	BLANK CASING O.3 to 13.4 feet
GPM FROM	то	- SENTONITE-CEMENT
TIME: GPM FROM	TO DATE:	SEAL OR
TOTAL WATER REMOVED DURING DEVELOPMENT:	GALLONS	- 8-SACK CEMENT SAND
DESCRIPTION		- <u>9</u> .0.5 teer
OF TURBIDITY CLEAR AT END OF DEVELOPMENT:	SLIGHTLY CLOUDY	BENTONITE PELLET SEAL
ODOR OF	RBID VERY MUDDY	_ <u>9</u> :0 // 'eet
WATER:		CO-ORADO SILICA
WATER DISCHARGED TO:	_	SAND PACK
TO: □STORM SEWE	RS STORAGE TANK	
DEPTH TO WATER AFTER DEVELOPMENT:		= 2 INCH DIAMETER
	FEET	nen · SCREEN
MATERIALS USED		13. 1/ · 0 23.4 inet
2.5 SACKS OF _5/4/C	1 65-je 20/40 SAND	2 INCH DIAMETER
	CEMEN	1 1 1 0, 44, 40, 40, 40, 40, 40, 40, 40, 40,
	USED (PORTLAND TYPE II CEM	
SACKS OF POWDERED	RIMTTON	BOTTOM WELL CAP
570 POUNDS OF BENTONI		
. = 1		HOLE CLEANED OUT T
TET OF LOCAL MEAN		
- C./	TOTORIES NEWSCO.	
V. 2-3	The second secon	
YARO3 CEMENT-SAND		NOT TO SCALE
YARD3 CEMENT-SAND	(REDI-MIX) USED	ADDITIONAL INFORMATION:
CONCRETE PUMPER USED?	YO TES	
NAME		
WELL COVER USED: ALOCKING	STEEL COVER	
CHRISTY	BUX .	



FIELD WELL COMPLETION	FORM				HRISTY BOX
					OCKING STEEL COVER
NAME: EAKER APB				═┓ <u></u> ┃╈┨╌┆	INCH DIAMETER
- NUMBER: 3K98	PROJECT GEO	me Gartself		, , , ,	ASING
LOGGED 106	EDITED BEN			- -	
	Jan DIN	DATE: 13/91		- ;	INCH DIAMETER
NAME: EILTWOG		15(15(4)			10
COMPANY: Pool	Drilling	DRILLER:			BENTONITE CEMENT
EQUIPMENT: 44 INCH HOL	LOW STEM AUGER	V. Barrazza			SEAL OR B-SACK CEMENT-SAND
INCH ROT	TARY WASH	DRILLED: 1.2	11 1	1 11 -:	SEAL
		GALLONS	_		101
METHOD OF DECONTAMINATION SPRING TO DRILLING:	Highpressure	STEAM	, [TOP OF CASING AT
DEVELOPMENT SEE WEU			1 1	1 1	BELOW GROUND LEVEL
METHOD OF			1 1		14 INCH DIAMETER
DEVELOPMENT:				+(BOREHOLE 0.0 :0 1 eet
BEGAN DATE:	TIME:	DATE:			a INCH DIAMETER
GPM FROM	то	DATE:			SCHEDULE 40 PVC BLANK CASING
GPM FROM	то				-0.3 to 13,50 feet
YIELD: TIME GPM FROM	.то	DATE:		• ×	BENTONITE-CEMENT
YIELD: TIME: FROM	то	DATE:			SEAL OR 8-SACK CEMENT-SAND SEAL
TOTAL WATER REMOVED DURING DEVELOPMENT:	×	GALLONS	.		Il 1020.5 leer
DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: MOD. TO	\ _	IGHTLY CLOUDY			BENTONITE PELLET
ODOR OF	OVER 1				Q to 11 'eet
WATER:					SAND PACK
WATER GROUND SU		AGETANK	İ		11 10 29 teet
□ DRUMS	OTHE	N .			A INCH DIAMETER
DEPTH TO WATER AFTER DEVELOPMENT:		FEET	1		SLOTTED : . CCG
MATERIALS USED				i≡:	3.50 to 23.70 feet
	•	•	•		2 INCH DIAMETER
3.5 SACKS OF 2	०। ५०	SAND			SCHEDULE 40 PVC BLANK SILT TRAP
SACKS OF		CEMENT	1		43.70 to 25.70 leet
~ 20 GALLONS OF GROU	TUSED (CEMENT	T/BENTONI TE	\mathbf{c}		BOTTOM WELL CAP
SACKS OF POWDER	ED BENTONITE				25.70 teet
50 POUNDS OF BENTO	VITE PELLETS		}-		- HOLE CLEANED OUT TO
13. 20 FEET OF 2 INCH	T PAC BLVWK CV217	iG			
10.00 C CONTROL OF CON		25.00			-24
2.00 164 16					
YAND CEMENTSA	NO TREDIMINI ORD	ERED	NC	T TO SCALE	•
YARD3 CEMENT-SA	ND (REDI-MIX) USE	D	A	DOITIONAL INF	ORMATION:
CONCRETE PUMPER USED?	XNO □YES		-		
NAME	`				
WELL COVER USED: X LOCKING CHRIST	Y BOX		_		



FIELD WELL COMPLETION FORM	CHRISTY BOX
	LOCKING STEEL COVER
NAME: EAKER AFB	TINCH DIAMETER
NUMBER: 3K98 PROJECT GVG	CASING
LOGGED INC STA	to
WELL EITUO7 DATE: 12/13/91	BOREHOLE
DRILLING A.W. COOL	
EQUIPMENT: VINCH HOLLOW STEM AUGER V. BAZZAZZO	BENTONITE CEMENT
6/4 455 3/3/92 MOURS	8 SACK CEMENT-SAND
	tofeet
USED DURING DRILLING: NONE GALLONS	
PRIOR TO DRILLING: PRESSURE STEAM	TOP OF CASING AT O 15 FEET ABOVE AT
DEVELOPMENT SEE DEVELOPMENT FORM	BELOW GROUND LEVEL I
METHOD OF DEVELOPMENT:	THE BOREHOLE
DEVELOPMENT SEGAN DATE: TIME:	0 :0.3℃ 1eet
VIELD: TIME: TO DATE	2 INCH DIAMETER
YIELD: TIME: GATE:	SCHEDULE 40 PVC BLANK CASING
YIELD: TIME: DATE:	-0.15 to 15.07 feet
GPM FROM TO	● □ BENTONITE-CEMENT SEAL OR
TOTAL WATER REMOVED	B SACK CEMENT-SAND
DURING DEVELOPMENT: GALLONS	
DESCRIPTION OF TURBIDITY OF CLEAR OF CHOOSE CLEAR OF CLOUDY	BENTONITE PELLET
DEVELOPMENT: MOD. TURBID VERY MUDDY	SEAL 1(:0 13 'est
GDOR OF WATER:	Colorado 90/40
DISCHARGED GROUND SURFACE TANK TRUCK	SAND PACK 13 10 2-7 1eet
OSTORM SEWERS STORAGE TANK ODRUMS SOTHER	2 INCH DIAMETER
DEPTH TO WATER	SLOTTED 10-00 (
AFTER DEVELOPMENT: FEET	-15.07 to 25.15 feet
MATERIALS USED	2 INCH DIAMETER
21/2 SACKS OF COLO. SILVER 20/40 SAND	SCHEDULE 40 PVC
SACKS OFCEMENT	BLANK SILT TRAP
GALLONS OF GROUT USED	BOTTOM WELL CAP
SACKS OF POWDERED BENTONITE	-97.15 leet
50 POUNDS OF BENTONITE PELLETS	HOLE CLEANED OUT TO
14.92 FEET OF 2 INCH PVC BLANK CASING	300
H 4 3 JAK FEET OF 2 INCH PVC SLOTTED SCREEN	BOTTOM OF BOREHOLE
2.00 TES	
YARO3 CEMENT-SAND (REDT-MIX) ORDERED	NOT-TO SCALE
YARD CEMENT-SAND (REDI-MIX) USED	ADDITIONAL INFORMATION:
CONCRETE PUMPER USED? AND THE	WET 8 - S
NAME	WELL AGANDONED :/8/92
WELL COVER USED: ALOCKING STEEL COVER	
□CHRISTY BOX	



		FORM				—í _`	
100 FOY	er. Afb			ln-			LOCKING STEEL CO
100 214	48.	PROJECT MANAGER:	Cic	41-	-	1	STEEL CONDUCTOR
LOGGED , D.C.				11			tofeet
ev: CRE		8Y:	3FN			-	INCH DIAMET
NAME: ELITA	nos		12/14/91				BOREHOLE
	W. POOL	, •					10feet
EQUIPMENT: JAL	71- RICH HOL	LOW STEM AUG	ER V. BARRAZZO				SEAL OR
<u> </u>	INCH ROT	'ARY WASH	HOURS DRILLED: 0.75				8-SACK CEMENT-SA
GALLONE OF WAT	TER HILLING: んと	NE	GALLONS				tofeet
METHOD OF DEC			GU PRESSURE)	1			TOP OF CASING AT
	SEE WELL			1		-6	FEET ABOVE
METHOD OF	266 0000	Deven 1				4	1/4 INCH DIAMET
DEVELOPMENT:			/-].		SOMETION
SEGAN DATE:	TIME	TIME:	IDATE:				0 :0 29 1000 2 10100 01445
GPM	FROM	то				4	SCHEDULE 40 PVC
GPM	FROM	то /	DATE:				BLANK CASING
YIELD: GPM	TIME	то /	DATE:			l _	
VIELD:	TIME	70	DATE:				BENTONITE-CEMEN SEAL OR 8-SACK CEMENT-SA
TOTAL WATER R	EMOVED	\	GALLONS				SEAL
DESCRIPTION			40000	.	یا ل	222	to feet
OF TURBIDITY			** AL OLION	<u> </u>			
AT END OF	CLEAR	\ _	SLIGHTLY CLOUDY	\$		***	- BENTONITE PELLE SEAL
AT END OF DEVELOPMENT:	MOD. TU	\ _	SLIGHTLY CLOUDY VERY MUDDY				SEAL
ODOR OF WATER:	□ MOD. TU	IRBIO 🔲	VERY MUDDY				Colo. Silien 20/
ODOR OF WATER:	GROUND SUI	RFACE TAN	VERY MUDDY				Y:0 6 'est Cou. Siven 201
ODOR OF WATER:	□ MOD. TU	RFACE TAN	VERY MUDDY NK TRUCK DRAGE TANK				SEAL 1:0 6 1eee
ODOR OF WATER: WATER DISCHARGED TO:	GROUND SUI	RFACE TAMERS STO	VERY MUDDY NK TRUCK DRAGE TANK				SEAL 1:0 6 1eee Cour. Silven 30/ SAND PACK 1:0 25 1eee 2 INCH DIAME SLOTTED (.000
ODOR OF WATER: WATER: WATER DISCHARGED TO: DEPTH TO WATER	GROUND SUI	RFACE TAMERS STO	VERY MUDDY NK TRUCK DRAGE TANK HER				SEAL 1:0 6 1eee Cove. Silven 30/ SAND PACK 6:0 25 1eee
ODOR OF WATER: WATER DISCHARGED TO: DEPTH TO WATE AFTER DEVELOY MATERIALS US	GROUND SUI	RFACE TAN	VERY MUDDY NK TRUCK DRAGE TANK HER				SEAL 1:0 6 1eee Cold. Silver 30/ SAND PACK 6 10 25 1eee A INCH DIAME SLOTTED (.00C Inch) SCREEN 8.20 102320 fee
ODOR OF WATER: WATER DISCHARGED TO: DEPTH TO WATE AFTER DEVELOY MATERIALS US	GROUND SUI	RFACE TAN	VERY MUDDY NK TRUCK DRAGE TANK HER				SEAL To 6 'eee Cold. Silven 20/ SAND PACK To 25 eee A INCH DIAME SLOTTED (.00C Inch) SCREEN
ODOR OF WATER: WATER DISCHARGED TO: DEPTH TO WATE AFTER DEVELOR MATERIALS US	GROUND SUI	RFACE TAMERS STO	VERY MUDDY NK TRUCK DRAGE TANK HER FEET				SEAL 10 6 1000 COLL. SILICA 201 SAND PACK 6 10 25 1000 A INCH DIAME SLOTTED F. OOC 1000 SCREEN 8.20 10 23:20 Fee 2 INCH DIAME SCHEDULE 40 PVO
ODOR OF WATER: WATER DISCHARGED TO: DEPTH TO WATER AFTER DEVELOR MATERIALS US 2.5 SAC	GROUND SUIT GROUND SUIT GSTORM SEWE DRUMS PMENT: SED CKS OF Silica	RFACE TAMERS STO	VERY MUDDY NK TRUCK DRAGE TANK HER FEET SAND				SEAL 1:0 6 1eee COLL. SILICA 20/ SAND PACK 1:0 25 1eee 2 INCH DIAME SCHEDULE 40 PVC BLANK SILT TRAP 23.70 1025.20 1ee BOTTOM WELL CAL
DEPTH TO WATER DISCHARGED TO: DEPTH TO WATER AFTER DEVELOP MATERIALS US SAC GAI	GROUND SUI GROUND SUI GSTORM SEWE GDRUMS FMENT: SED CKS OF	RFACE TAMERS STO	VERY MUDDY NK TRUCK DRAGE TANK HER FEET SAND				SEAL 1:0 6 1eet COLL. SILICA 20/ SAND PACK 10 25 1eet A INCH DIAME SLOTTED (.00C Inch) SCREEN 8.20 10 23:20 fee 2 INCH DIAME SCHEDULE 40 PVC BLANK SILT TRAP 23.70 10 25:20 1ee
DEPTH TO WATER DISCHARGED TO: DEPTH TO WATER AFTER DEVELOPMATERIALS US 2.5 SAC GAI GAI DEPTH TO WATER AFTER DEVELOPMATERIALS US 2.5 SAC POL	GROUND SUIT GROUND SUIT GSTORM SEWE DRUMS CKS OF SITE CAR CKS OF GROUT CKS OF POWDEREI JNOS OF BENTONI	RFACE TAMERS STO	VERY MUDDY NK TRUCK DRAGE TANK HER FEET SAND CEMENT				SEAL 1:0 6 1eet COLL. SILICA 20/ SAND PACK 1:0 25 1eet 2 INCH DIAME SLOTTED (.00C 1:0:N) SCREEN 8.20 102320 feet 2 INCH DIAME SCHEDULE 40 PVC BLANK SILT TRAP 23.20 1025.20 1eet BOTTOM WELL CAI 25.20 1eet HOLE CLEANED O
DEPTH TO WATER DISCHARGED TO: DEPTH TO WATER AFTER DEVELOP MATERIALS US 2.5 SAC GAI 50 POL 8.00 FEE	GROUND SUI GROUND SUI GSTORM SEWE DRUMS R PMENT: SED CKS OF	RFACE TAMERS STO	VERY MUDDY NK TRUCK DRAGE TANK HER FEET SAND CEMENT				SEAL 1:0 6 1eet COLL. SILICA 20/ SAND PACK 1:0 25 1eet 2 INCH DIAME SLOTTED (.00C 1:0:1) SCREEN 8.20 1023:20 fee 2 INCH DIAME SCHEDULE 40 PVC BLANK SILT TRAP 23.20 1025:20 1eet BOTTOM WELL CAI 25.20 1eet HOLE CLEANED OF 25 1eet
DEPTH TO WATER DISCHARGED TO: DEPTH TO WATER DEPTH TO WATER AFTER DEVELOPMENT: AFTER DEVELOPMENT: DEPTH TO WATER AFTER DEVELOPMENT: SAC SAC SAC SAC SAC SAC SAC SAC SAC SAC	GROUND SUIT GROUND SUIT GSTORM SEWE DRUMS CKS OF SITE CAR CKS OF GROUT CKS OF POWDEREI JNOS OF BENTONI	RFACE TAMERS OF OTHERS USED D BENTONITE ITE PELLETS PVC BLANK CAS	VERY MUDDY NK TRUCK DRAGE TANK HER FEET SAND CEMENT				SEAL 10 6 1000 SAND PACK 10 25 1000 A INCH DIAME SLOTTED (.000 Inch) SCREEN 8.20 102320 fee 2 INCH DIAME SCHEDULE 40 PVO BLANK SILT TRAP 23.20 1025-20 100 BOTTOM WELL CAI 25.20 1000 1
DEPTH TO WATER DISCHARGED TO: DEPTH TO WATER DEPTH TO WATER AFTER DEVELOPMENT: AFTER DEVELOPMENT: DEPTH TO WATER AFTER DEVELOPMENT: SAC SAC SAC SAC SAC SAC SAC SAC SAC SAC	GROUND SUIT STORM SEWE DRUMS CKS OF SILLONS OF GROUT CKS OF POWDEREIT UNDS OF BENTONIET OF LINCH	RFACE TAMERS OF OTHERS USED D BENTONITE ITE PELLETS PVC BLANK CAS	VERY MUDDY NK TRUCK DRAGE TANK HER FEET SAND CEMENT				SEAL 10 6 1eet COLC. SILICA 201 SAND PACK 10 25 1ee 2 INCH DIAME SLOTTED (.00C Inch) SCREEN 8.20 to 23:20 fee 2 INCH DIAME SCHEDULE 40 PVC BLANK SILT TRAP 23.20 to 25:20 fee BOTTOM WELL CAI 25.20 feet HOLE CLEANED O 25 1eet
DEPTH TO WATER DISCHARGED TO: DEPTH TO WATER AFTER DEVELOPMENT: WATER DEVELOPMENT: WATER: WATER: WATER: WATER: WATER: SAC SAC SAC SAC SAC SAC SAC SAC SAC SAC	GROUND SUIT OF LINCHLET OF LIN	RFACE TAMERS STORES USED D BENTONITE ITE PELLETS PVC BLANK CASE PVC SLOTTED SC	VERY MUDDY NK TRUCK DRAGE TANK HER FEET SAND CEMENT		NOT TO SO	CALE	SEAL 1:0 6 1ee COLL. SILVEN 201 SAND PACK 1:0 25 1ee 2 INCH DIAME SCHEDULE 40 PVC BLANK SILT TRAF 23.70 10 25.20 1ee BOTTOM WELL CA 25.20 1eet HOLE CLEANED 0 25 1eet BOTTOM OF BORE 29 1eet
DEPTH TO WATER DISCHARGED TO: DEPTH TO WATER AFTER DEVELOPMENT: WATER DEVELOPMENT: WATER: WATER: WATER: WATER: WATER: SAC SAC SAC SAC SAC SAC SAC SAC SAC SAC	GROUND SUI GROUND SUI GSTORM SEWE DRUMS RMENT: SED CKS OF	RFACE TAMERS STORES USED D BENTONITE ITE PELLETS PVC BLANK CASE PVC SLOTTED SC	VERY MUDDY NK TRUCK DRAGE TANK HER FEET SAND CEMENT			CALE	SEAL 1:0 6 1eee COLL. SILVEN 201 SAND PACK 1:0 25 1eee 2 INCH DIAME SLOTTED (.00C 1:0:N) SCREEN 8.20 1023:20 fee 2 INCH DIAME SCHEDULE 40 PV BLANK SILT TRAF 23.70 1025:20 1ee BOTTOM WELL CA 25.20 1eee HOLE CLEANED O 25 1eee BOTTOM OF BORE 29 1eee
DEPTH TO WATER DISCHARGED TO: DEPTH TO WATER AFTER DEVELOPMENT: WATER DEVELOPMENT: WATER: WATER: WATER: WATER: WATER: SAC SAC SAC SAC SAC SAC SAC SAC SAC SAC	GROUND SUI GROUND SUI GSTORM SEWE DRUMS CKS OF	RFACE TAMERS STORES USED D BENTONITE ITE PELLETS PVC BLANK CAS PVC SLOTTED SC	VERY MUDDY NK TRUCK DRAGE TANK HER FEET SAND CEMENT			CALE	SEAL 1:0 6 1eee COLL. SILICA 201 SAND PACK 1:0 25 1eee 2 INCH DIAME SLOTTED (.00C Inch) SCREEN 8.20 102320 fee 2 INCH DIAME SCHEDULE 40 PV BLANK SILT TRAF 23.70 1025.20 1ee BOTTOM WELL CAI 25.20 1eee HOLE CLEANED O 25 1eee BOTTOM OF BORE 29 1eee
DEPTH TO WATER DISCHARGED TO: DEPTH TO WATER DISCHARGED TO: MATERIALS US AFTER DEVELOR MATERIALS US SAC SAC SAC SAC SAC SAC SAC SAC SAC SAC	GROUND SUI GROUND SUI GSTORM SEWE DRUMS CKS OF	RFACE TAMERS STORES USED D BENTONITE ITE PELLETS PVC BLANK CAS PVC SLOTTED SC	VERY MUDDY NK TRUCK DRAGE TANK HER FEET SAND CEMENT			CALE	SEAL 1:0 6 1eet COLC. SILICA 20/ SAND PACK 1:0 25 1eet 2 INCH DIAME SCHEEN 8.20 102320 feet 2 INCH DIAME SCHEDULE 40 PVO BLANK SILT TRAP 23.70 1025.20 feet HOLE CLEANED OF 25 1eet BOTTOM OF BORE 29 1eet
DEPTH TO WATER DISCHARGED TO: WATER DEVELOR MATERIALS US ACTOR SACTOR	GROUND SUI GROUND SUI GSTORM SEWE DRUMS CKS OF	RFACE TAMERS OTTO	VERY MUDDY NK TRUCK DRAGE TANK HER FEET SAND CEMENT			CALE	SEAL 1:0 6 1eet COLL. SILICA 20/ SAND PACK 1:0 25 1eet 2 INCH DIAME SCHEDULE 40 PVC BLANK SILT TRAP 23.70 10 25.20 1eet HOLE CLEANED OF 25 1eet BOTTOM OF BORE 29 1eet



FIELD Y	YELL COM	PLETION FO	RM				CHRISTY BOX
JOS NAME:	EAKER	A 5-0			l l		LOCKING STEEL COVER
108	3K98	PR	DIECT	Guc	41-	-	INCH DIAMETER
NUMBER:			HAGER:	GUG			CASING
6Y:	LRE	87	1	BFN			tofeet
WELL MAME:	EIITW	1109		12/14/91			BOREHOLE
COMPANY	. A.W.	POOL					tofeet
COUIPMEN	T: 0 644	INCH HOLLOW	STEM AUG	ER V. BARRAZZO	.		BENTONITE CEMENT
	ā	_ INCH ROTARY	WASH	HOURS 50			8 SACK CEMENT SAND
GALLONS	OF WATER	- 11015		BIR	• •	• '	
METHOD (OF DECONTAL	MINATION (WE STEAM		-	TOP OF CARING AT
				MENT FORM			TOP OF CASING AT
METHOD () F	c were b	CVECOP	MENT POISM			GELOW GROUND LEVEL
DEVELOP			-				BOREHOLE
TIELD:			ME:	Tores			<u>0 :0 25 1000</u>
	GPM FRO	M TO		DATE:		-	SCHEDULE 40 PVC
YIELD:	GPM FRO	_		OATE:			BLANK CASING
YIELD:	GPM FRO			DATE:			-0.2 to 8.20 feet
YIELD:	GPM FRO	E:		DATE:		-	SEAL OR
	TER REMOVE	CD		CALLONS		-	8-SACK CEMENT-SAND
DESCRIPT	108	_		GALLONS		<u> </u>	ro feer
OF TURBI AT END O DEVELOP	F MEMT.	CLEAR		SLIGHTLY CLOUDY			BENTONITE PELLET
000805		MOD. TURBIO	u	VERY MUDDY	×		4:06
WATER:						-	OCCILADOSILICA BO/40
DISCHARG	3 6 6	ROUND SURFAC TORM SEWERS		IK TRUCK RAGE TANK			SAND PACK
		RUMS	□ oT+				2 INCH DIAMETER
DEPTH TO	WATER EVELOPMENT:	•		FEET			SLOTTED 1.006
MATERIA	ALS USED						8.20 to 18.20 feet
•		C		201			INCH DIAMETER
2.5	_ SACKS OF	COLORAC	POSILICA	CONS CANO			SCHEDULE 40 PVC BLANK SILT TRAP
				CEMENT			18.2010 20.20 leet
	_ GALLONS	OF GROUT USED)				BOTTOM WELL CAP
50	_ SACKS OF	POWDERED BEN	ITONITE				20.20leet
	_ POUNDS O	F BENTONITE PE			_		HOLE CLEANED OUT TO
			NCH PVC BLANK CASING				22 1991
		> INCH PVC S		REEN	L		BOTTOM OF BOREHOLE
200	FRET OF						Ø 3 100
YARD CEMENT-SAND (REDI-MIX) ORDERED					NC NC	T.TO SCA	LE
	YARD ³ CE	MENT-SAND (RE	DI-MIX) US	ED **	, , , , , , , , , , , , , , , , , , ,	DOITIONA	L INFORMATION:
CONCRET	E PUMPER US	ED7 NO	☐YES				cuyed in 31
NAME		·		<u></u>	-		
WELL CO	VER USED:	LOCKING STEE	L COVER				
	į	Д̀сняізту вох Дотнея			_		



FIELD WELL COMPLETION	N FORM			CHRISTY BOX
				LOCKING STEEL COVER
AME: FAICEN				INCH DIAMETER
UMBER: 3K9B	PROJECT GVG	<u>-</u>		STEEL CONDUCTOR CASING
LRE	BEN BEN			
AME: EILTWILLO	DAT	12/14/91		BOREHOLE
MILLING AW POOL	<u></u>			
	971	LLERI		BENTONITE CEMENT
	HOLLOW STEM AUGER	JAS _		SEAL OR 8-SACK CEMENT-SAND
ALLONS OF WATER		LLED: 55		SEAL .
SED DURING DRILLING: ETHOD OF DECONTAMINATIO		LONS		
RIOR TO DRILLING:	HIGH PRESSURE	STEAM		TOP OF CASING AT
DEVELOPMENT SEE WE	TL DEVELOPMENT	FORM		BELOW GROUND LEVE
AETHOD OF DEVELOPMENT:				BOREHOLE
DEVELOPHENT DEGAN DATE:	TIME:			O to 25 leet
GPM FROM	TO	TE:		2 INCH DIAMETER
IELD: TIME:	TO DAT	196		SCHEDULE 40 PVC BLANK CASING
GPM FROM	OA	TE:		-0.20 to -8.20 feet
GPM FROM	TO	FE:	-	SEAL OR
GPM FROM	70		-	B-SACK CEMENT-SANG
OTAL WATER REMOVED DURING DEVELOPMENT:	GAL	LONS		4 .0 ~0 × 1 mm
DESCRIPTION OF TURBIDITY CLEA	R ☐SLIGHT	TLY CLOUDY		BENTONITE PELLET
	TURBIO VERY	MUDDY		SEAL 4:0 6 reet
DON OF VATER:				Coungoe sinch bolyo
MATER GED GROUND	=			SAND PACK
STORM SE	EWERS STORAGE	TANK		2
SEPTH TO WATER		-		SLOTTED 1,006
MATERIALS USED	FEE	- · · · · · · · · · · · · · · · · · · ·		1020 SCREEN -8.30 1941
MA I ENINES OSED				2 INCH DIAMETE
2.5 SACKS OF	ica brade	SAND		SCHEDULE 40 PVC BLANK SILT TRAP
SACKS OF		CEMENT		18.20 -00.39
\sim 5 Gallons of Gro	UTUSED (LEMENT/	SENTONO PE)		BOTTOM WELL CAP
SACKS OF POWDE				feet
50 POUNDS OF BENT	ONITE PELLETS			HOLE CLEANED OUT
8.00 FEET OF 2 IN	CH PVC BLANK CASING			221111
10.00 FEET OF 2 INC	H PYC SLOTTED SCREEN.			80TTOM OF BOREHO
\$ 700 FEST OF				1087
YARO CEMENTS	MO IRCO WITH BELLING		NOT TO SCA	LE
YARD CEMENTS	AND THEUT-MIXTUSED		ADDITION	L INFORMATION:
CONCRETE PUMPER USED?	BNO DAEZ			
NAME				
WELL COVER USED: DLOCK				
□ CHRIS				



	FIELD WELL COMPLETION	FORM			CHRISTY BOX	
	FIELD WELL COMPLETION				LOCKING STEEL COVER	
	NAME: EAKER AFB				TINCH DIAMETER	
	HUMBER: 31.58	PROJECT MANAGER: G	16,		CASING	
	LOGGED BFAI	EDITED 15	<i>3</i>			
	WELL EITWILL		DATE: 12-15-91		BOREHOLE	
	DRILLING POOL					
		LOW STEM AUGER	V. BUTTLE ZG		BENTONITE CEMENT	
		ARY WASH	HOURS .42		8 SACK CEMENT SAND	
	GALLONS OF WATER	ひ とど 色	GALLONS			
		pressure			TOP OF CASING AT	
			MENT FORM		BELOW GROUND LEVEL	
1	METHOD OF	30, 33,		`	6 14 INCH DIAMETER	
	DEVELOPMENT:			1	BOREHOLE O :0 2 2 1 per	
	SEGAN DATE:	TIME:	DATE:		Z INCH DIAMETER	
	GPM FROM	TO-	DATE:		SCHEDULE 40 PVC BLANK CASING	
	GPM FROM	то	DATE:		0./ to 8./ feet	
	GPM FROM	то /	DATE:		SEAL OR	
İ	GPM FROM	то			B SACK CEMENT SAND	
	TOTAL WATER REMOVED DURING DEVELOPMENT:	<u> </u>	GALLONS	535	5.5 10 ~0.5 feet	ļ
	OF TURBIDITY CLEAR	· 🚾	IGHTLY CLOUDY		BENTONITE PELLET SEAL	l
	DEVELOPMENT: MOD. TI	JRSID UV	ERY MUDDY	888	5.5 :0 6.5 'eet	
	ODOR OF WATER:			<u> </u>	COLORADO SILICA ZOLA	ĺ
	WATER GROUND SU	_	TRUCK AGE TANK		6.5 10 72 1001	l
	DRUMS	□отне	R	. =	Z INCH DIAMETER SLOTTED 1 0.006	
	DEPTH TO WATER AFTER DEVELOPMENT:		FEET	.	non SCREEN	
	MATERIALS USED			. =	8 / :0 /8 ·/ iest	
	2.5 SACKS OF Silico	A Grade	SAND		SCHEDULE 40 PVC BLANK SILT TRAP	
	SACKS OF		CEMENT	.	18.1 to 20.1 feet	
	~≤ GALLONS OF GROU		NT/BENTONITE	mix)	BOTTOM WELL CAP	
	SACKS OF POWDER	ED BENTONITE	,		<u>20./</u> feet	į
	25 POUNDS OF BENTON	IITE PELLETS			HOLE CLEANED OUT TO	!
-	A FEET OF 2 INCH			L	BOTTOM OF BOREHOLE	
	FEET OF Z INCH	PVC SLOTTED SCR	REEN		∂∂.,	
# 1 F	CONTROL OF THE PROPERTY OF THE		SDEO.	NOT	TO SCALE	= ;
	YARO TOWN	EDIMIXI ORC			ITIONAL INFORMATION:	
		INO □YES		A00	THE PROPERTY OF THE PROPERTY O	
		70.00 11.53		_		
	WELL COVER USED: LOCKIN	IG STEEL COVER				
١	CHRIST					
- 1	COTHER			-		



FIELD WELL COMPLETION	N FORM			CHRISTY BOX
-IELD HELL COM ELTIO				LOCKING STEEL COVE
OB LAME: EAKEL AFB				INCH DIAMETER
0.9	PROJECT MANAGER: G	VG		STEEL CONDUCTOR CASING
NUMBER: 3K98	EDITED			tofeet
LOGGED LY: BFX/	1	DATE:		NCH DIAMETE
WELL EITHIIZ		12-15-91		tofeet
COMPANY: POUL DINKINS				BENTONITE CEMENT
EQUIPMENT: 61/4 INCH HO	LLOW STEM AUGER	V. Burazza		SEAL OR 8-SACK CEMENT-SAN
II INCH RO	TARY WASH	DRILLED: 1.25		SEAL .
CALLONS OF WATER		GALLONS		tofeet
USED DURING DRILLING! N	015	UACCO.13	Commod-	TOP OF CASING AT
	lean cleaned			FEET ABOVE A
DEVELOPMENT SEE WEL	L DEVELOPME	ENT FORM		BELOW GROUND LEV
hethod of		1		BOREHOLE
DEVELOPMENT:				0 :0 25 len
BEGAN BATE:	TIME:	DATE:		a INCH DIAMET
SPM FROM	то	OATE:		SCHEDULE 40 PVC BLANK CASING
GPM FROM	то	/		O./ to O./ feet
YIELD: TIME:	то	DATE:		BENTONITE-CEMENT
YIELD: TIME:		DATE:		SEAL OR B-SACK CEMENT-SAM
GPM FROM	. το			SEAL SEAL
TOTAL WATER REMOVED DURING DEVELOPMENT:		GALLONS		ro feet
DESCRIPTION CLEAR	i∕ 📐 □si	LIGHTLY CLOUDY		BENTONITE PELLET
DEVELOPMENT: MOD.	TURBID 📉 🗆 V	ERY MUDDY		5 :0 6.5 rem
ODOR OF		•		ברעהבאטר בובובא בו
WATER:	URFACE TANK	TRUCK		SAND PACK
DISCHARGED STORM SE		AGE TANK		<u>#-5</u> 10 <u>∂5./</u> 1001
DRUMS	□отн			2 INCH DIAME
DEPTH TO WATER AFTER DEVELOPMENT:		FEET		SLOTTED 1 0-00 6
MATERIALS USED			=:	8.1 :0 23.1 iges
		•		2 INCH DIAME
3:5 SACKS OF 514	C.4 GRADE	SAND		SCHEDULE 40 PVC BLANK SILT TRAP
SACKS OF		CEMENT		23./1025./100
GALLONS OF GRO			d	BOTTOM WELL CAP
SACKS OF POWDER				<u>35./</u> teet
75 POUNDS OF BENTO				HOLE CLEANED OF
8 FEET OF 2 INC		NG		<u> 25-/</u> 1-41
			<u></u>	BOTTOM OF BORE
15 FEET OF JING	ULACTOT IED 201	14.61		
			NOTATOS	ACE .
	NO INFIDANT OR			ALTNFORMATION:
YARD ³ CEMENT-S		0		
CONCRETE PUMPER USED?	NO ALEZ			al WAS pulled ?
NAME			Groute	to Surface on 12
WELL COVER USED: ALOCKI	NG STEEL COVER		5-11	recovery of well so
ÉHRIS	TY BOX		•	•
LIOTHE	R		FR150	



FIELD WELL COMPLETION	FORM	CHRISTY BOX		
199	□ LOCKING STEEL COVER			
NAME: EAKER AFB	STEEL CONDUCTOR			
	MANAGER: GVG	CASING		
LOGGED LRE	15 FN			
WELL EITWII3	12/15/91	BOREHOLE		
COMPANY: AWPOOL		tofeet		
EQUIPMENT: TO VET INCH HOLL	LOW STEM AUGER V. BARAAZA	BENTONITE CEMENT		
	ARY WASH HOURS	8-SACK CEMENT-SAND		
	30 GALLONS	tofeet		
	tIGH PRESSURE STEAM	TOP OF CASING AT		
	L DEVELOPMENT FORM	O.15 FEET ABOVE AT BELOW GROUND LEVEL		
METHOD OF		6'4 INCH DIAMETER		
DEVELOPMENT:		BOREHOLE C:0-27		
PERAN DATE:	TIME:			
GPM FROM	TO DATE:	2 INCH DIAMETER		
GPM FROM	то	BLANK CASING		
GPM FROM	TO DATE:	SENTONITE-CEMENT		
GPM FROM	DATE:	SEAL OR SACK CEMENT-SAND		
TOTAL WATER REMOVED GALLONS		SEAL		
DESCRIPTION DELEAR	SLIGHTLY CLOUDY	BENTONITE PELLET		
AT END OF DEVELOPMENT: MOD. TU	RBID VERY MUDDY	SEAL 4		
CDOR OF WATER:		LOW SANT SILICA ZU/4		
WATER / DEBOUND SUE	RFACE TANK TRUCK	SAND PACK		
TO: USTORM SEWE	<u> </u>	to 25.25		
DRUMS	☐ R3HTO	INCH DIAMETER		
DEPTH TO WATER	FEET	SLOTTED (O.COG		
MATERIALS USED		\$.35 to 23.25		
		2 INCH DIAMETER		
SACKS OF COLOR	ADO 20/40SAND	SCHEDULE 40 PVC 8LANK SILT TRAP		
SACKS OF	CEMENT	23.25 to LS.25 test		
GALLONS OF GROUT	USED	BOTTOM WELL CAP		
SACKS OF POWDERED BENTONITE		25-25 teet		
50 POUNDS OF BENTONITE SELLETS		HOLE CLEANED OUT T		
8.2 FEET OF 2 INCH PVC BLANK CASING				
19,7 FEET OF TINCHT	WEST-OTTED SCREEN	BOTTOM OF BOREHOL		
	HEDIMIXI ORBERED	NOT TO SCALE		
YARD CEMENT-SAN		ADDITIONAL INFORMATION:		
CONCRETE PUMPER USED?	NO TYES	Materials pulled; well		
NAME		growted to the surface		
WELL COVER USED: MLOCKING	STEEL COVER (NONE USED 158 3/3	1/192) 12/18/41 753		
□ CARIST U				



FIELD WELL COMPLETION	N FORM	CHRISTY BOX		
100 NAME: EAKER AFB		LOCKING STEEL COVE		
NUMBER: 3K98	PROJECT GVG	STEEL CONDUCTOR CASING		
LOGGED URE	EDITED BEN			
WELL EITWILLY	DATE: 12/16/91	INCH DIAMETER		
DRILLING IN LA PIONI	1) [6] [1]	SURENOLE		
	ORILLER:			
_	DELOW STEM AUGER J. BANNAZA	SEAL OR SEAL OR SEAL OR		
GALLONS OF WATER	TARY WASH ORILLED:	II I II SEAL -		
USED DURING DRILLING	OCNE GALLONS			
METHOD OF DECONTAMINATION PRIOR TO DRILLING:	TEAM CICANED	TOP OF CASING AT		
DEVELOPMENT SEE WED	L DEVELOPMENT FORM	GELOW GROUND LEVE		
METHOD OF DEVELOPMENT:		GORENOLE DIAMETER		
DEVELOPMENT BEGAN QATE:	TIME:	BOREHOLE		
TIME:	TO DATE:	2 INCH DIAMETER		
TIME:	TO DATE:	SCHEDULE 40 PVC BLANK CASING		
TIME:	DATE	-10-1 to 6.2 feet		
GPM FROM	TO DATE:	SENTONITE-CEMENT		
GPM FROM	то	SEAL OR SACK CEMENT-SAND		
DURING DEVELOPMENT:	GALLONS	SEAL 2 to Seer		
DESCRIPTION DF TURBIDITY	SLIGHTLY CLOUDY	BENTONITE PELLET		
DEVELOPMENT: MOD/T	URBID VERY MUDDY	SEAL * 2 :0 4 'eet		
DDOR OF WATER:		(s) (b) orado 20/40		
MATER GROUND SL		SAND PACK		
TO: STORM SEW DRUMS	ERS STORAGE TANK			
DEPTH TO/WATER	FEET	INCH DIAMETE		
MATERIALS USED	PEEI	inch SCREEN		
2 SACKS OF Color	ado Silica 20/40 SAND	SCHEDULE 40 PVC BLANK SILT TRAP		
SACKS OF	CEMENT	16.4 10.18.4		
GALLONS OF GROUT	TUSED (CEMENT/BENTONITE BENTON			
SACKS OF POWDERE	D BENTONITE 5	EAL 18.4 tem		
1 00 POUNDS OF BENTON		HOLE CLEANED OUT		
6.1 FEET OF 2 INCH		Ca/E-IN CAC 1981		
10.2 FEET OF 2 INCH	PVC SLOTTED SCREEN	BOTTOM OF BOREHOL		
. 2.05/		A Marian		
	D (REDI-MIX) ORDERED	NOT TO SCALE X ALCO ,		
YARDI CEMENT-SAN	O (REDI-MIX) USED	ADDITIONAL INFORMATION: BELLE		
CONCRETE PUMPER USED?	NO TYES	SEAL From 18-22'		
NAME				
WELL COVER USED: DOCKING CHRISTO	BOX			



FIELD WELL COMPLET	TION FORM			CHRISTY BOX
HAME: EAKER AF	R			LOCKING STEEL COVER
HUMBER: 31C98	PROJECT MANAGER:	Gue	4	STEEL CONDUCTOR
LOGGED URE	EDITED B	7.7		CASING
NAME: EIITWIIIS		DATE: 12/16/91		INCH DIAMETER
COMPANY: A.W. POD	C			BOREHOLE
_	H HOLLOW STEM AUGER	DRILLER: V. BARRAZA		BENTONITE-CEMENT SEAL OR B-SACK CEMENT-SAND
GALLONS OF WATER	H ROTARY WASH	ORILLED: 1.0		SEAL SEAL
METHOD OF DECONTAMINAT	とっかも	GALLONS		toteet
PRIOR TO DRILLING:	HOT PRESSIN			TOP OF CASING AT
DEVELOPMENT SEE DE	evelopment f	rest		FEET ABOVE AT
METHOD OF DEVELOPMENT:				674
DEVELOPMENT BEGAN DATE:	TIME:			-01 -530
GPM FROM	то	DATE:		2 INCH DIAMETER
GPM FROM	то	DATE:		SCHEDULE 40 PVC BLANK CASING
TIME: GPM FROM	то	DATE:		-0.1 to 6.2 feet
GPM FROM	то	DATE:		SEAL OR
TOTAL WATER REMOVED OURING DEVELOPMENT:	\times	GALLONS		8-SACK CEMENT-SAND
DESCRIPTION OF TURBIDITY AT END OF	AR 🔲 SL	IGHTLY CLOUDY		~0,5,0 2 feer
DEVELORMENT.		RY MUDDY		BENTONITE PELLET SEAL *
ODOR OF WATER:				GLOGADO SILICA DOLLO
	SURFACE TANK	TRUCK		SAND PACK
STORM S	SEWERS STORA	GE TANK		10 18 1001
DEPTH TO WATER	OTHER			2 INCH DIAMETER
MATERIALS USED		FEET	i 🖃	SLOTTED 1 0.00 6
				6.2 to 10.3 ince
SACKS OF COL	orano Siuca B	9/40 SAND		SCHEDULE 40 PVC
SACKS OF		CEMENT		BLANK SILT TRAP
GALLONS OF GRO	OUT USED (CEMEN	T/BENTON. TE)		
SACKS OF POWDE				BOTTOM WELL CAP
POUNDS OF BENT			-	HOLE CLEANED OUT TO
	ICH PVC BLANK CASING			21 1711
	CH PVC SLOTTED SCREE			BOTTOM OF BOREHOLE
The second secon				
YARD CEMENTS	AND (REDI-MIX) ORDER	RED		LE
			_	L INFORMATION:
CONCRETE PUMPER USED?	MNO TAE2		PEWET	3 18-21 TO SEAL
WELL COVER USED: XLOCK	ING STEEL COVER		off Lo	WER WATER ZONE
☐ CHRIS	STY BOX			
Потне	A			
				



	CHRISTY BOX
	Z LOCKING STEEL COVER
NAME: 1 EAKER AFB	INCH DIAMETER
NUMBER: 3K98 PROJECT MANAGER: (NG	CASING
LOGGED LRE EDITED BEN	tofeet
WELL EITTWIG TWILL 12/14	BOREHOLE
DRILLING	
COMPANY:	BENTONITE CEMENT
INCH HOLLOW STEM AUGER V.B. CO	8-SACK CEMENT-SAND
INCH ROTARY WASH DRILLED	.: O·S
GALLONS OF WATER USED DURING DRILLING: — GALLONS	
METHOD OF DECONTAMINATION PRIOR TO DRILLING: 1-EGH PRESSURE STEPAN	TOP OF CASING AT
DEVELOPMENT	S.Z. FEET ABOVE AT
METHOD OF	CV4 INCH DIAMETER
DEVELOPMENT:	BOREHOLE O :0 22 leet
BEGAN DATE: TIME: DATE:	
GPM FROM TO	INCH DIAMETER
GPM FROM TO	BLANK CASING O. Z. to 7.4 feet
YIELD: TIME: OATE:	SENTONITE-CEMENT
YIELD: TIME: DATE:	SEAL OR
TOTAL WATER REMOVED	CEA
	'0feet
OF TURBIDITY CLEAR SLIGHTLY OF AT END OF DEVELOPMENT: CHOOK TURBID CLEAR MINE	SEAL
OMOD. TORSIO U VERY MODE	
ODOR OF WATER:	ECLUZADO SILICA
WATER DISCHARGED DISCHARGED DISCHARGED DISCHARGED DISTORM SEWERS DISTORAGE TANK	SAND PACK
DRUMS OTHER	2 INCH DIAMETE
DEPTH TO WATER AFTER DEVELOPMENT: FEET	SLOTTED 1 0.000
MATERIALS USED	7.9 18 0 iest
	2 INCH DIAMETE
3 SACKS OF 20/46 COLORADO SILLICA	SAND SCHEDULE 40 PVC BLANK SILT TRAP
SACKS OF	CEMENT 18 to 20 feet
4 GALLONS OF GROUT USED (CENEUT / BENT	
SACKS OF POWDERED BENTONITE	20 teet
25 POUNDS OF BENTONITE PELLETS	HOLE CLEANED OUT
10 FEET OF 2 INCH PVC BLANK CASING	<u> 22</u> (set
10 FEETOE INCH BUC ST OFFEO SCREEN 2.3	Cut of BOTTOM OF BOREHO
YARD CEMENT SANO (REDI MIX) ORDERED	NOT TO SCALE
YARD CEMENT-SAND (REDI-MIX) USED	ADDITIONAL INFORMATION:
CONCRETE PUMPER USED? MO DYES	Screen was originally
NAME	set from 9.4-19.5 feet
WELL COVER USED: ELOCKING STEEL COVER	well was pulled up 1.5'
7 - 1	W-C (WAC () & (U.C. V-D) 1'1
CHRISTY BOX	and completed 12/17/91



FIELD WELL COMPLETIO		CHRISTY BOX		
LAKER AF		LOCKING STEEL COVE		
NUMBER: 3K98	PROJECT SVG	─────────────────────────────────────	INCH DIAMETER STEEL CONDUCTOR CASING	
LRE	EDITED BEN			
WELL EII- TWIL	9 DATE:	1, 7, 6	INCH DIAMETER	
201111111		[17 [91	BOREHOLE	
COMPANY: AW CO	·····	<u> </u>	BENTONITE CEMENT	
A CAT INCH H	DLLOW STEM AUGER V. BAG	RAZA	SEAL OR	
INCH R	OTARY WASH PRILLED	<u>.) </u>	8-SACK CEMENT-SAND	
SALLONS OF WATER USED DURING DRILLING:	IONE GALLONS	<u> </u>		
METHOD OF DECONTAMINATION PRIOR TO DRILLING:	PRESSULE STEAM	. f	TOP OF CASING AT	
DEVELOPMENT SEE WE	L DEVELOPMENT F	5000	O . 2 FEET ABOVE AT	
METHOD OF	DEVELOR INCOME	01070	COSTONOUND CEAS	
DEVELOPMENT:			BOREHOLE	
IEGAN OATE:	TIME:		J18 0 :0 22 see	
SPM FROM	то		SCHEDULE 40 PVC	
GPM FROM	TO DATE:		BLANK CASING	
GPM FROM	TO DATE:		0.2 to 5 feer	
GPM FROM	TO DATE:		SEAL OR	
OTAL WATER REMOVED			8-SACK CEMENT-SAND	
DESCRIPTION /	GALLONS		2 10 0.5 feet	
T TURBIDITY CLEAR		LOUDY	BENTONITE PELLET	
DON OF	URBID VERY MUDD	<u>Y</u>	SEAL 2 10 3 feet	
WATER:			COLORADO SILICA ZO	
MATER DISCHARGED GROUND S TO: GSTORM SEV			SAND PACK_	
□ DRUMS	VERS STORAGE TANK		3:0-17 1001	
DEPTH TO WATER AFTER DEVELOPMENT:	FEET		2 INCH DIAMETE	
MATERIALS USED			HON SCREEN	
			75 :0 5 ieur	
3 SACKS OF COLOR	ADO SILICA 20/40	SAND	SCHEDULE 40 PVC	
SACKS QF		CEMENT	BLANK SILT TRAP	
GALLONS OF GROU	TUSED (LEMENT BENTON:	TE MIX)	§ §	
SACKS OF POWDER	ED BENTONITE	BENTONITE }	BOTTOM WELL CAP	
25 POUNDS OF BENTO	NITE PELLETS	SEAL 17-18'	HOLE CLEANED OUT T	
4.8 FEET OF 2 INCH PVC BLANK CASING			20 fret	
10.0 FEET OF 3 INCH	PVC SLOTTED SCREEN	<u>L</u>	BOTTOM OF BOREHOL	
	The Superior			
YARO ¹ CEMENT SAI	ND (REDI MIX) DROERED	NOT	TO SCALE	
	NO (REDI-MIX) USED		ITIONAL INFORMATION:	
	ZNO □YES	200		
NAME		_		
WELL COVER USED: XLOCKIN	G STEEL COVER			
□CHRIST □OTHER				



	FIELD WELL COMPLETION FORM			☐ CHRISTY BOX			
							LOCKING STEEL COVE
		NAME: EAKER AFIS 108 108 108 108 108 108 108 10	13X SI	hopette	4		STEEL CONDUCTOR CASING
		LOGGED ICA	EDITED	11			
			I BF	DATE:			6/4 INCH DIAMETER
		DRILLING A . 2 0 -		11-7-92	-		BOREHOLE O to 30 lear
		COMPANY: AW FOOL		DRILLERI			BENTONITE CEMENT
		674 INCH HOL		V. BARAZZA	\		SEAL OR BISACK CEMENT-SAND
			HZAW YRA	DRILLED: . 88	1.1	1 1	SEALleet
ľ		USED DURING DRILLING: NON		GALLONS			Note: STICK DOWN NO.Z
		METHOD OF DECONTAMINATION PRIOR TO DRILLING:	PRESSURE	STEAM	1		JOP OF CASING AT 1/4,
	/	DEVELOPMENT SEE WELL	DEVELOPINE	NT FORM			BELOW GROUND LEVE
	`	METHOD OF DEVELOPMENT:					BOREHOLE
		DERELOPMENT BEGAN DATE:	TIME:				0 :0 30 1mm
		GPM FROM	то	GATE:		-	2 INCH DIAMETER
		TIME!	то	DATE			BLANK CASING
		YIELDI TIMEI	16	DATE			2.8 to 17.2 feet
		VIELDI TIMEI	то	DATE			SEAL OR B-SACK CEMENT-SAND
		TOTAL WATER REMOVED DURING DEVELOPMENT:		GALLONS			SEAL
i		DESCRIPTION	n.	IGHTLY CLOUDY	22		
		OF TUNBIDITY AT END OF DEVELOPMENT: MOD. TU	_	ERY MUDDY	***		SEAL
		500R 0F			,	224 (22) 	15 :0 16 1000 CALORADO SILICA
\downarrow		WATER DGROUND SUR	RFACE DJANK	TRUCK		-	SANO PACK ZOLYC
		TO: SEWE	RS STOR	AGE TANK	'		30 10 16 1000 V
		DRUMS	□отне	*			S INCH DIAMETER
- 1		AFTER DEVELOPMENT:		FEET			HEN SCREEN
- }		MATERIALS USED					17.2 :0 27.2 feet
ł		Z 100# SACKS OF COLORAGE	DE SINCA 20/	40 SAND			SCHEDULE 40 PVC
Ì		SACKS OF PORTIAL	TUPE I	CEMENT			BLANK SILT TRAP
		GALLONS OF GROUT	USED				OTTOM WELL CAP
I		SACKS OF POWDERED	BENTONITE				29.21eer
- 1		SO POUNDS OF BENTONI	TE PELLETS		. -	<u>. — — — — — — — — — — — — — — — — — — —</u>	HOLE CLEANED OUT TO
		20 FEET OF 1 INCH P	VC BLANK CASIN	<u> </u>			30,,,,
13		NCH P					Cast Cast
	· 	I PRET OF 2 IN	•	·			
~	•••	YARO ² CEMENT-SAND			N	OT TO SCA	LE
- [YARDI CEMENT-SAND	A	l			L INFORMATION:
		CONCRETE PUMPER USED?	go □YEZ				cut of ~35' of
		WELL COVER USED: LOCKING	STEEL COVER		_		
		CHRISTY			_		SH OMPLETED WELL
1							



FIELD WELL COMPLETION FORM				CHRISTY BOX
				D LOCKING STEEL COVER
HAME: baker A FB	PROJECT	4	STEEL CONDUCTOR	
NUMBER: D)14	MANAGER:	Jeneins		CASING feet
RPH	EDITED HE	Inare:		INCH DIAMETER
MAME: MW1121		4/8/95		BOREHOLE
COMPANY: Ju - State	Testing			10feat
EQUIPMENT: DIT INCH HOL	LOW STEM AUGE	A The Thank		BENTONITE-CEMENT
INCH ROT	HZAW YRA	MOURS VO		8 SACK CEMENT-SAND
GALLONS OF WATER USED DURING DRILLING:	†	GALLONS		feet
METHOD OF DECONTAMINATION PRIOR TO DRILLING:		mer	-	TOP OF CASING AT
		MENT FORM		22 FEET ABOVE AT
METHOD OF DEVELOPMENT:				- 184 INCH DIAMETER
DEVELOPMENT				BOREHOLE 0 :0 16.7 (see
SEGAN DATE: VIELD: TIME!	TIME:	DATE:		1
GPM FROM	70	DATE:		SCHEDULE 40 PVC BLANK CASING
GPM PROM	то	DATE		+ 2.4 to 4.2 feet
GPM FROM	το		-	E SENTONITE-CEMENT
GPM FROM	TO	DATE:	-	SEAL OR 8-SACK CEMENT-SAND
TOTAL WATER REMOVED DURING DEVELOPMENT:	•	GALLONS		SEAL O -o 10feet
DESCRIPTION CLEAR	s	LIGHTLY CLOUDY		BENTONITE PELLET
AT END OF DEVELOPMENT: MOD. TU	RSID U	VERY MUDDY		SEAL 1.0 .0 1.0
ODOR OF WATER:				20/40 MORIESIUCA
WATER GROUND SUI	RFACE TAN	K TRUCK		SANO PACK
TO: STORM SEWE		AGE TANK		3.0 0/6 / feer
DEPTH TO WATER	□отн	7		SLOTED (0.01
AFTER DEVELOPMENT:		FEET		inch · SCREEN
MATERIALS USED				<u>4.2</u> to <u>14.2</u> feet
SACKS OF5	olb 20/40 9	nine SAND		2 INCH DIAMETER SCHILDLE 40200 5.5(4) BLANK SILT TRAP
SACKS OF		CEMENT		14.2 10 16.2 1eet
GALLONS OF GROUT	USED			BOTTOM WELL CAP
SACKS OF POWDERE	DBENTONITE	•		16.2 reat
75 POUNDS OF BENTON				HOLE CLEANED OUT TO
8(+) 4.95 FEET OF 2 INCH	e 6		1	1
FEET OFINCH!	S.S. SUPER SCR	REEN		BOTTOM OF BOREHOLE
YARD ³ CEMENT-SAND (REDI-MIX) ORDERED			NOT TO SCA	ALE .
YARO3 CEMENT-SAND (REDI-MIX) USED			ADDITIONA	L INFORMATION:
CONCRETE PUMPER USED?	no Oyes			
WELL COVER USED: LOCKING				



FIELD WELL COM	PLETION FORM			CHRISTY SOX
	C D			INCH DIAMETER
	FB	e: A Tentino	41-1	STEEL CONDUCTOR CASING
IUMOER: DIT	MAMAGE			
BDH	EDITED	6 A W ()		INCH DIAMETER
MWII22		4/7/95		BOREHOLE
OMPANY:	grave Josting	(nountre o		BENTONITE CEMENT
OUIPMENT: D 74	_ INCH HOLLOWSTEM	AUGER DRILLE TLASSEL		SEAL OR BESACK CEMENT SAND
0	_ INCH ROTARY WASH	DRILLED:	(1 l)	10 1991
ALLONS OF WATER ISEO GURING DRILLIN	a, NA	GALLONS		
METHOD OF DECONTA PRIOR TO DRILLING:	MINATION Ston	Jepan		2.3 2.5 FEET ABOVE AT
DEVELOPMENT	SEE WELLD	eizuorment form		AS W GROUND LEVEL
METHOD OF DEVELOPMENT:	•			OF INCH DIAMETER
DEVELOPMENT BEGAN DATE:	TIME:			0 :0 17.9 1 cert
VIELD: GPM FRO		DAYEI	} }	2 INCH DIAMETER
VIELD: TIM	ık:	DAYE:		BLANK CASING
PIELD: CPM FAC	i C :	DAYE:		SENTONITE CEMENT
VIELD: TIM	i Bi	DATE		SEAL OR B-SACK CEMENT-SAND
TOTAL WATER REMOV	/4D	GALLONS		SEAL 0 102.0 feat
DESCRIPTION	DCLEAR	SLIGHTLY CLOUDY		BENTONITE PELLET
OF TURBIDITY AT END OF DEVELOPMENT;	MOD. TURBIQ	□ VERY MUDDY		SEAL 2.0 10 4.0 1001
0008 07	-		n	20/40 MORIE SILLE
WATER	GROUND SURFACE	MANK TRUCK		SAND PACK
=		STORAGE TANK		2 INCH DIAMETE
DEPTH TO WATER	DAUMS [FEEDLE		SLOTTED (D. D.)
AFTER DEVELOPMEN	Ť1	FEED		5.1 to 15.1 feet
MATERIALS USED				2 INCH DIAMETER
11.5 SACKS O	F THE SOLD HOR	20/40 Marie SAND		BLANK SILT TRAP
SACKS O	F	CEMENT		1 <u>5.1</u> 10 <u>17.3</u> 1eet
	S OF GROUT USED		=	BOT OM WELL CAP
	F POWDERED BENTON			HOLE CLEANED OUT
POUNDS	OF BENTONITE PELLET	rs - annic		7.9 leet
FEET OF	INCH PVC BLAN	K CASING	<u> </u>	BOT OM OF BOREHOL
2.2 Feet of	L INCH PYCSLOTT	1+ trop		17. 9 toet
	EMENT-SAND (REDI-MI		NOT TO	SCALE
	EMENT-SAND (REDI-MI		ADDIT	ONAL INFORMATION:
CONCRETE PUMPER	USED7 NO N	'ES		
NAME		,		
WELL COVER USED:	LOCKING STEEL CO	NER		
	OTHER			
	*			

FIELD WELL COMPLETION FORM	CHRISTY BOX		
100	LOCKING STEEL COVER		
MAME! Eaber AFB	INCH DIAMETER		
MANAGER: Allan Jenkins	STEEL CONDUCTOR CASING		
G. Millar Je alla	toteet		
MAME: NW1123 811195	BOREHOLE		
company Tri State Testing Services	tofeet		
EQUIPMENT M LO INCH HOLLOW STEM AUGER J. Crawford	BENTONITE-CEMENT SEAL OR		
INCH ROTARY WASH DRILLED!	SEAL CEMENTSAND		
USED DURING DRILLINGS 7 GALLONS for drock or			
METHOD OF DECONTAMINATION PRIOR TO DRILLING: STRAM CLEANING			
DEVELOPMENT SEE Well Development Form	TOP OF CASING AT		
METHOD OF DEVELOPMENT	BELOW CHOUND TEAST		
DEVELOPMENT	BOREHOLE		
VIELDI TIMEI DATEI	Q :0 1915 1eet		
GPM FROM TO	SCHEDULE 40 PVC		
GPM FROM TO	BLANK CASING		
GPM FROM TO	<u> </u>		
GPM FROM TO	SEAL OR		
OURING DEVELOPMENT: GALLONS	SEAL		
OF TURBIDITY CLOUDY	0 10 3:0 leet		
DEVELOPMENT: DMOD. TURBIO DVERY MUDDY	BENTONITE PELLET SEAL		
GDOR OF WATER:	3.0 to 5.0 teet		
MATER DESCHARGED DESCHARGE DESANK TRUCK	Morie 20140 [manc] SANO PACK		
USTORM SEWERS STORAGE TANK	5.0 10 19.5 teer		
DEPTH TO WATER	2 INCH DIAMETER		
MATERIALS USED	SLOTTED (-0/0)		
12.0 062495 000 GA CON WELL	7.10 to 7.00 feet		
HISTOM SACKS OF Morie 20140 Filtration medigano	SCHEDULE 10 PE S.STEEL		
SACKS OFCEMENT	BLANK SILT TRAP		
SALLONS OF GROUT USED	BOTTOM WELL CAP		
SACKS OF POWDERED BENTONITE	19.01es 15 ft of sand		
75 125 POUNDS OF BENTONITE PELLETS 1 1/2 buckets	HOLE CLEANED OUT TO		
FEET OF D INCH PVC BLANK CASING	1 <u>9.5</u> (ee)		
10 FEET OF 2 INCH ANSISLOTTED SCREEN	BOTTOM OF BOREHOLE		
•	(Tries lock		
YARD ³ CEMENT-SAND (REDI-MIX) ORDERED YARD ³ CEMENT-SAND (REDI-MIX) USED	NOT TO SCALE		
CONCRETE PUMPER USED? WHO THES	ADDITIONAL INFORMATION:		
NAME grow mixed in 55 gal drum	calcusated sand = 11.31 sacks		
WELL COVER USED: ALOCKING STEEL COVER	Calculated grout = 11.76 gap		
CHRISTY BOX			
OOTHER			

FIELD WELL COMPLETION FORM	CHRISTY BOX
NAME: Faker AFB	☐ LOCKING STEEL COVE
NUMBER: 0114 PROJECT MANAGER: Allan Jenkin	S INCH DIAMETER STEEL CONDUCTOR CASING
LOGGED G. Millow EDITED	tofeet
WELL MW1124 9112195	INCH DIAMETER
COMPANYITri State Testing Services	BOREHOLE to feet
EQUIPMENT: 10 INCH HOLLOW STEM AUGER J. C. C. C. C. C.	
INCH ROTARY WASH	SEAL OR SEAL OR SEAL OR
GALLONS OF WATER USED DURING DRILLING; 50 GALLONS	10feet
prior to Drilling: Steam Cleaning	TOP OF CASING AT
DEVELOPMENT See Well Development for	1.65 FEET ABOVE AT
METHOD OF OEVELOPMENT:	BELOW CHOUND LEVEL
DEVELOPMENT	BOREHOLE
YIELD: TIME: DATE:	0 :0 38 feet
GPM FROM TO TIELD: TIME: DATE:	2 INCH DIAMETER
GPM FROM TO	BLANK CASING O 10 26 leet
GPM FROM TO	S SENTONITE-CEMENT
GPM FROM TO	SEAL OR SEAL OR SEAL OR
TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS	SEAL
OF TURBIDITY DCLEAR DSLIGHTLY CLOUDY	
DEVELOPMENT: MOD. TURBID VERY MUDDY	BENTONITE PELLET SEAL
GDOR OF WATER:	22:0 24 reel
DISCHARGED GROUND SURFACE TANK TRUCK	SAND PACK
ORUMS OTHER	241038 feet
DEPTH TO WATCH	2 INCH DIAMETER
MATERIALS USED	SLOTTED (O.O.O.)
DE 24 PA CACO INICH	26 en 36 feut
12 1/2 SACKS OF Morie 20/40 Fittration Medius AND	2 INCH DIAMETER SCHEDULE 40 PMC 55
SACKS OFCEMENT	BLANK SILT TRAP 36 to 38 feet
2 65 GALLONS OF GROUT USED	BOTTOM WELL CAP
SACKS OF POWDERED BENTONITE	38 leer
50 POUNDS OF BENTONITE PELLETS 1 16 buckets	HOLE CLEANED OUT TO
30 FEET OF 2 INCH FVC BLANK CASING 2 Feet 55 CL	38 1941
2 FT of 2 inch so silt trap	BOTTOM OF BOREHOLE
YARD CEMENT-SAND (REDI-MIXI ORDERED	NOT TO SCALE
YARD CEMENT-SAND (REDI-MIX) USED	ADDITIONAL INFORMATION:
CONCRETE PUMPER USED? THO TYES	calculated sand 10.93 sacks
WELL COVER USED: DELOCKING STEEL COVER	Calculated grout 36.24 gal.
CHRISTY BOX	
OTHER	



FIELD WELL COMPLETION FORM				CHRISTY BOX		
JOS HAME: FOL	- nc				TO LOCKING STEEL COVER	
100	ker AFI	PROJECT MANAGER:	Allan Jenkins	4	INCH DIAMETER STEEL CONDUCTOR CASING	
LOGGEO C.	Millar	EOITEO JA			tofeet	
WELL	W1125		10/3/196		- INCH DIAMETER	
ORILLING		2001a 5			BOREHOLE	
		esting S	DRILLERI		BENTONITE-CEMENT	
		OLLOW STEM AUG OTARY WASH	HOURS DRILLED:		SEAL OR B-SACK CEMENT-SAND SEAL	
GALLONS OF WATUSED DURING DA	TEN HLLING:	70	GALLONS		tofeet	
METHOD OF DEC	ONTAMINATION NG:	steam (Lleanina		TOP OF CASING AT	
DEVELOPMENT	SOP WO		onunt form		2.9 27 FEET ABOVE AT	
METHOD OF DEVELOPMENT:	-	4)			BELOW GROUND LEVEL	
DEVELOPMENT					10 INCH DIAMETER	
VIELD:	TIME	TIME:	DATE:		0 :0 38 leet	
YIELD:	FROM	TO	DATE:		SCHEDULE 40 PVC	
VIELD:	FROM	TO .	DATE:		BLANK CASING	
GPM	FROM	то			DENTONITE-CEMENT	
GPM	FROM	то	DATE:		SEAL OR BSACK CEMENT SAND	
FOTAL WATER RE DURING DEVELOP	MOVED MENT:		GALLONS		SEAL	
DESCRIPTION OF TUNBLOITY AT ENO OF DEYELOPMENT;	CLEAR	\	SLIGHTLY CLOUDY VERY MUDDY		BENTONITE PELLET SEAL	
POOR OF					32 :0 24 (cc)	
VATER DISCHARGED	GROUND SU	:	K TRUCK		SAND PACK	
o:	DRUMS	ERS STO	RAGE TANK		24 10 38 feet	
EPTH TO WATER		<u> </u>	· ·		SLOTTED (0.010)	
SEU ZLAIRETAN			FEET GR		inch SCREEN S.S. 26 to 36 feet	
9		5 GA OON W			2 INCH DIAMETER	
			commod/asano		BLANK SILT TRAP	
			CEMENT		36 , 38 100	
GALLO	ONS OF GHOUT		•	<u></u>	BOTTOM WELL CAP	
			14 buckets		38 her	
			ng 1.5f+ cut off		HOLE ILLEANED OUT TO	
10 FEET C	DE DE INCH	S SI OTTEN CASI	SEN		80TTOM OF BOREHOLE	
a FT					38 leet	
			· · · · · · · · · · · · · · · · · · ·	NOT TO SCALI		
YARD ³ CEMENT-SAND (REDI-MIX) ORDERED YARD ³ CEMENT-SAND (REDI-MIX) USED				ſ		
ONCRETE PUMPER			-		INFORMATION:	
AME		- W. ca			ated Sand=10.92500	
	Missering	STEEL COVER		calcula	ted grout - 80.36 gar	
TEL GOVER OSED	CHRISTY &	iox				

;12-28-95 ; 4:57PM ;

ENT	BY	:BR	OWN	AND	ROO	T, ENV	
14		Ha	llib	urt	on l	VUS	
44		CO	RP	OR	ÀΤ	йой	

FIELD WELL COMPLETION FORM	CHRISTY BOX	
HAME: Fakur AFB	CI LOCKING STEEL COVE	
NUMBER: OILL PROJECT Allan Tenkins	INCH DIAMETER	
LOGGED G. Millar EDITED	CASING	
MELL MANE: MANE: MANE:	INCH DIAMETER	
DRILLING SOMPANY Tri-State Testing Services	BOREHOLE	
COULTERT: ZVI	BENTONITE-CEMENT	
INCH POTARY WACH HOURS	SEAL OR	
GALLONS OF WATER	II I II SEAL	
METHOD OF DECONTAMINATION		
DEVELOPMENT See Well Development Form	TOP OF CASING AT	
METHOD OF DEVELOPMENT:	BELOW GROUND LEVE	
DENETOWENT	O INCH DIAMETER	
VIELDI TIMET DATE:	0 :0 41 teet	
GPM FROM TO	2 INCH DIAMETER	
YIELD: TIME: DATE	BLANK CASING	
GPM FROM TO	GENTONITE-CEMENT	
TOTAL WATER REMOVED	SEAL OR SEACK CEMENT-SAND	
DESCRIPTION GALLONS	SEAL O 10 22 (ect	
OF TURBIDITY DELEAR DELIGHTLY CLOUDY	BENTONITE PELLET	
ODON OF	SEAL 22,0 24 /get	
WATER:	Morie 20140(004)	
DISCHARGED DICHOUND SURFACE TANK TRUCK	SAND PACK	
ORUMS DOTHER	27 to 41 lear	
AFTER DEVELOPMENT:	SLOTTED (0.0/0)	
MATERIALS USED	irch · SCREEN 29 to 39 teat	
91/2 SACKS OF MOVIE 20/10 filtration mighin	2 INCH DIAMETER	
SACKS OFCEMENT	SCHEOULE 40446- ST	
GALLONS OF GROUT USED	39 10 4/ Icer	
SACKS OF POWDERED BENTONITE	BOTTOM WELL CAP	
50 POUNDS OF BENTONITE PELLETS 1 544 CHR.	41 leet	
FEET OF A INCH BUC BY CACING 2 SCHOOL STORY	HOLE CLEANED OUT TO	
FEET OF A INCH PUE SLOTTED SCREEN	BOTTOM OF BOREHOLE	
2 FT of 2 inch s.s. si It trap	<u>41</u> lost	
YARD CEMENT SAND (REDI-MIX) ORDERED	NOT TO SCALE	
YARD CEMENT-SAND (REDI-MIX) USED	ADDITIONAL INFORMATION:	
CONCRETE PUMPER USED? DNO XYES	Calculated sond=10.92 topp	
WELL COVER USED: LOCKING STEEL COVER	calculated grout = 98 gals	
OCHRISTY BOX		
OTHER		

SURVDATA.XLS

SAMPLE LOCATION/ELEVATION EAKER AIR FORCE BASE, ARKANSAS

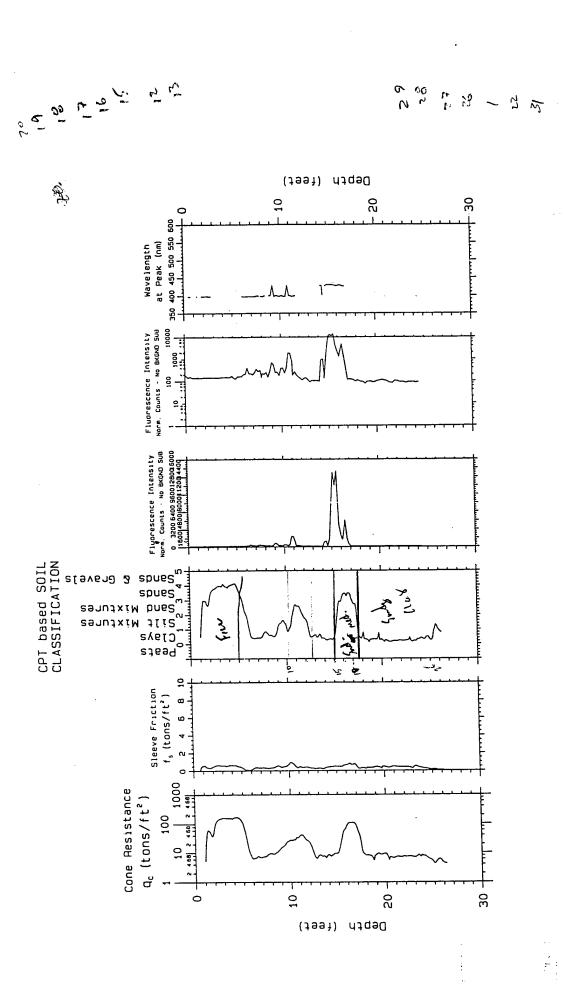
Sample	Elevation	Ground	Coordinates		Site
Point	TOC	Elevation	Northing	Easting	
TW1102	249.52		599301.20	2604930.49	RX
TW1103	249.99		599245.87	2605004.10	ВX
MW1104	251.48		599380.79	2605116.02	BX
TW1105	251.14		599340.38	2604984.22	BX
TW1106	250.98		599356.10	2604925.65	BX
TW1107	251.31		599377.34	2605044.84	BX
TW1108	250.75		599297.47	2605018.95	BX
TWI 109	250.89		599269.70	2605047,84	BX
MW1110	251.23		599285.35	2605052.46	BX
MW1111	251.32		599445.92	2605047.22	BX
TW1112	250.86		599348.57	2605017.22	BX
TW1113	252.01		599449.00	2604918.04	BX
MWI114	251.64		<i>5</i> 99513.89	2604985.04	BX
MW1115	250.37		599355.32	2504845.78	BX
MW1116	250.62		599187.31	2604940.79	BX
TW1117	250.83		599261.14	2605070.50	EX
TW1118	250.42		599233.00	2605100.52	BX
MW1119	249.75		599198.81	2605113.49	BX
MW1120	251.73	·	599447.41	2604838.18	BX
MW1121	253.16	250.97	599307.09	2605212.18	BX
MW1122	253.02	250.68	599488.98	2605029.14	BX
MW1123	253.56	251.13	599426.94	2604884.90	BX
MW1124	253.58	251.93	599440.75	2604894.57	BX
MW1125	253.48	280.58	599527. 42	2604778,54	BX
MW1126	253.70	250.91	599313.88	2605207.14	BX
MW1127	Z80.54	250.76	519181-58	2604946.87	BX
MW1128	STIL	- Remai	414 of 3414	よれべをかもか	BX
CP03		251.12	599361.54	2604978.20	BX
CP19		_			BX
CP22					BX
CP26		251.52	599356.27	2604925.70	BX
Bi		252.18	599386.58	2605029.03	BX
B2		251.96	599388.57	2605019.62	BX
B3		251.85	599388.65	2605008.02	BX
B4		251.75	599381.05	2604999.58	BX
B5		251.64	599373.17	2604995.29	BX
B6		251.77	599350.54	2604998.47	BX
87		250.97	599348.42	2605017.32	BX
88		250.98	599340. 55	2605031.63	BX
B9		251.12	599347.35	2605041.38	BX
B10		251.23	599354.04	2605048,24	BX
B11		251.26	59 9 361.16	2605055,91	BX
B12		251.56	599376.42	2605049,23	BX
B13		252.50	599393.30	2605039.89	BX

APPENDIX B - 1C

CPT/LIF OUTPUT

BX SHOPPETTE

Source: USACE 1995.

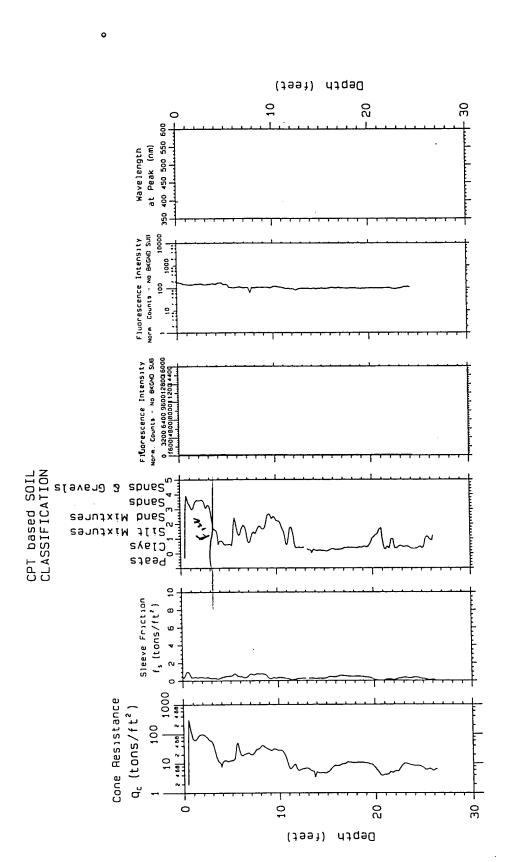


<NEW> 26.50 Probe Depth; Eaker AFB Project;

Site Characterization CPT; 01EAK01 Penetrometer System CPT;

Probing date; 03-24-1995

U.S.Army Engineer District Annsas City Geotechnical Branch



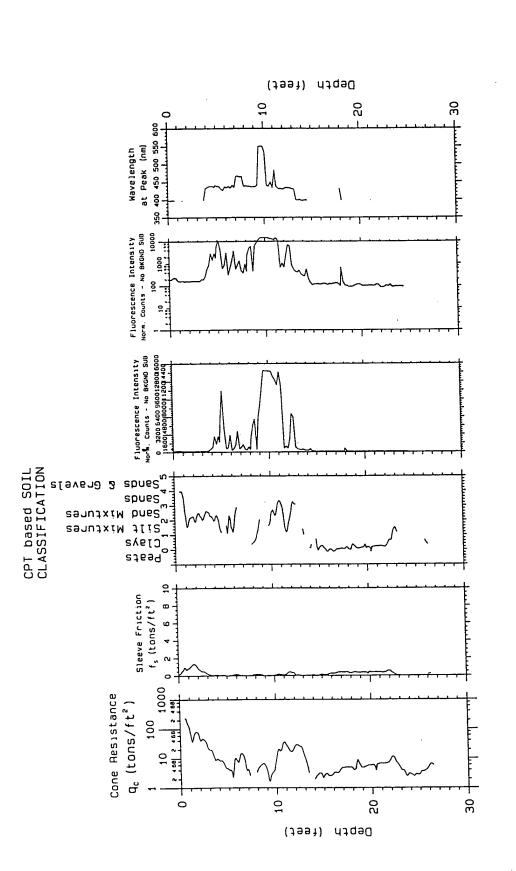
26.45 Eaker AFB Probe Depth; Project;

Site Characterization and Analysis Penetrometer System

CPT; 2EAK01

Laser induced
fluorescence
of POL via
fiber optics

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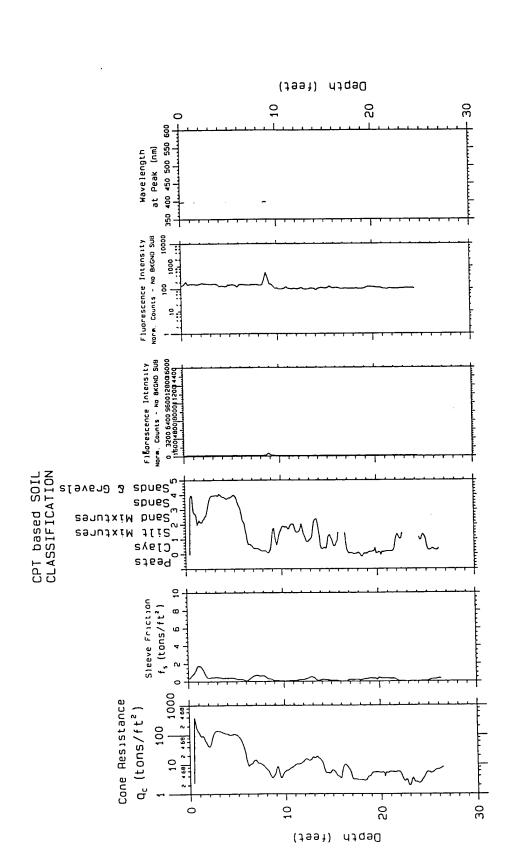
26.54 Eaker AFB Probe Depth; Project;

Laser induced fluorescence of POL via fiber optics

Probing date; 03-24-1995

U.S.Army Enginear District Kansas City Geotechnical Branch

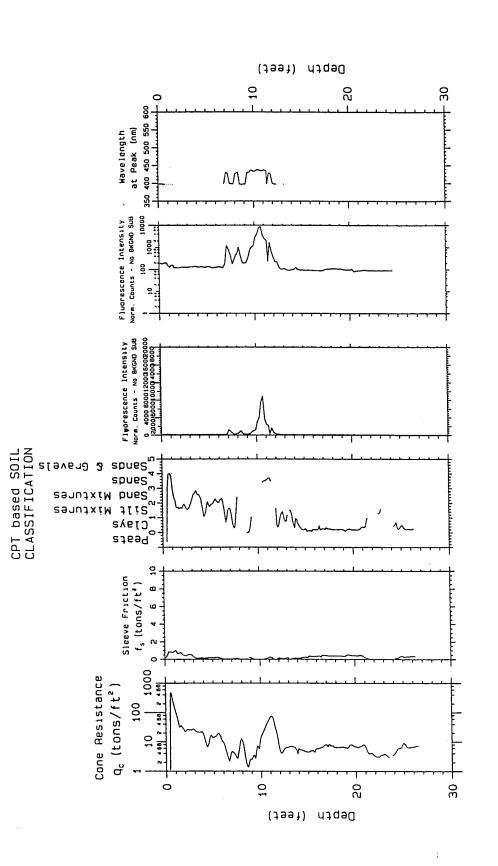
Site Characterization and Analysis Peretrometer System CPT.



Eaker AFB 26.59 Probe Depth; Project;

Site Characterization and Analysis Penetrometer System

CPT; 4EAK01

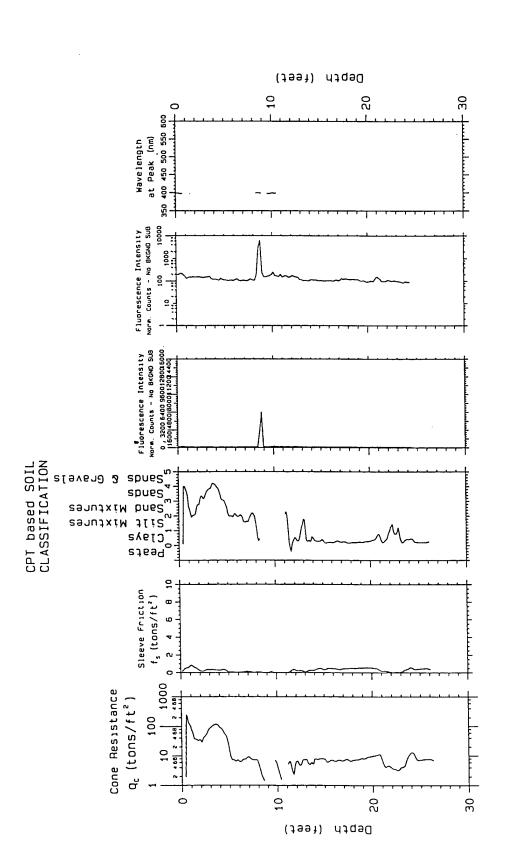


Eaker AFB 26.61 Probe Depth; Project;

5EAK01 Site Characterization and Analysis Penetrometer System CPT;

Probing date; 03-24-1995

U.S.Army Enginear District Kansas City Geotechnical Branch



26.50 Eaker AFB Probe Depth; Project;

; 6EAK01

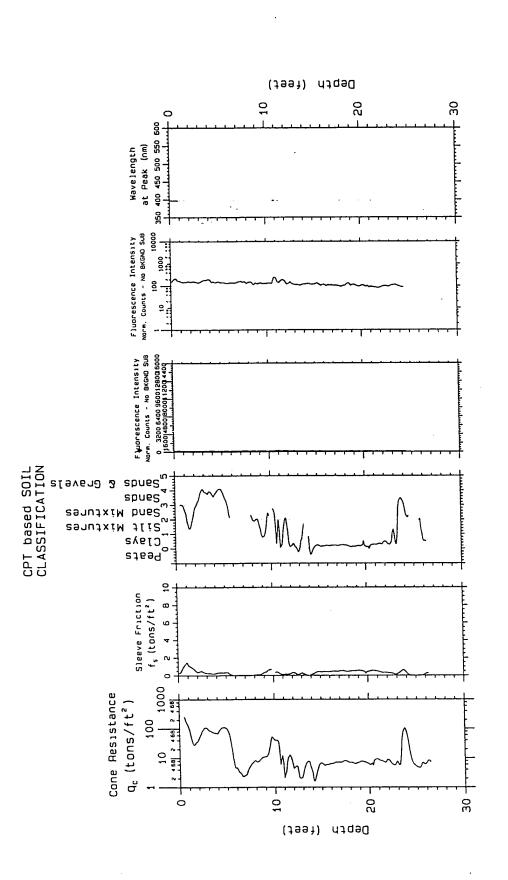
Site Characterization and Analysis Penetrometer Syste

U.S.Army Engineer District Kansas Cit) Geotechnic

Laser induced fluorescence of POL via

Probing date: 03-24-1995.

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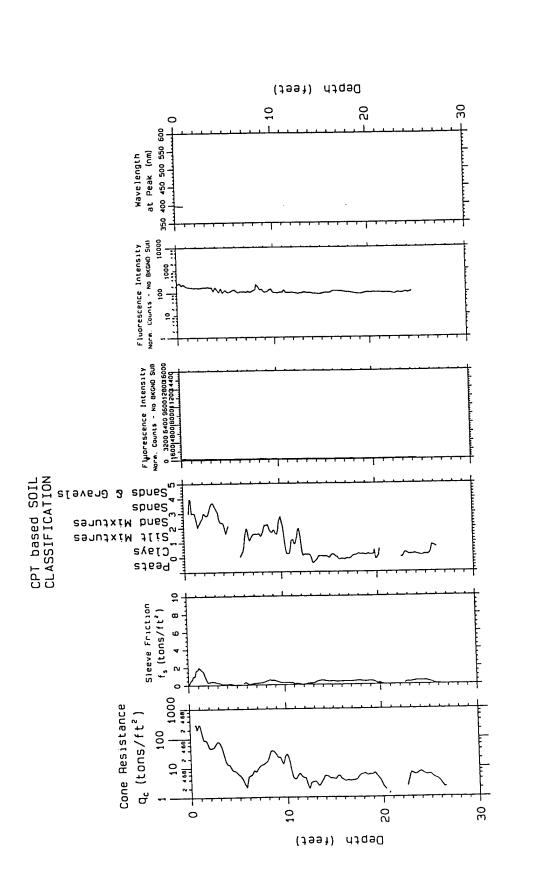
26.55 Eaker AFB Probe Depth; Project;

U.S.Army Engineer District Annsas City Geotechnical Branch

Laser induced fluorescence of POL via fiber optics

Site Characterization and Analysis Penetrometer System CPT;

Probing date; 03-24-1995



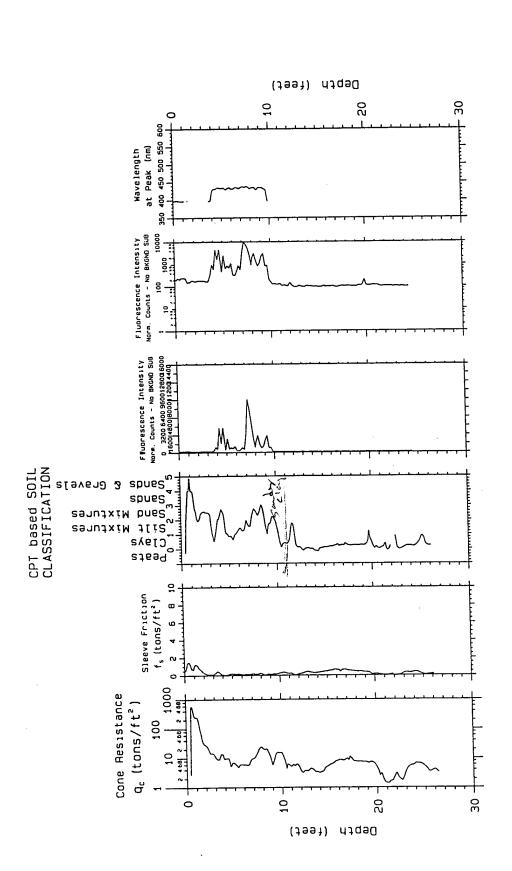
Eaker AFB 26.60 Probe Depth; Project;

Site Characterization and Analysis Penetrometer System

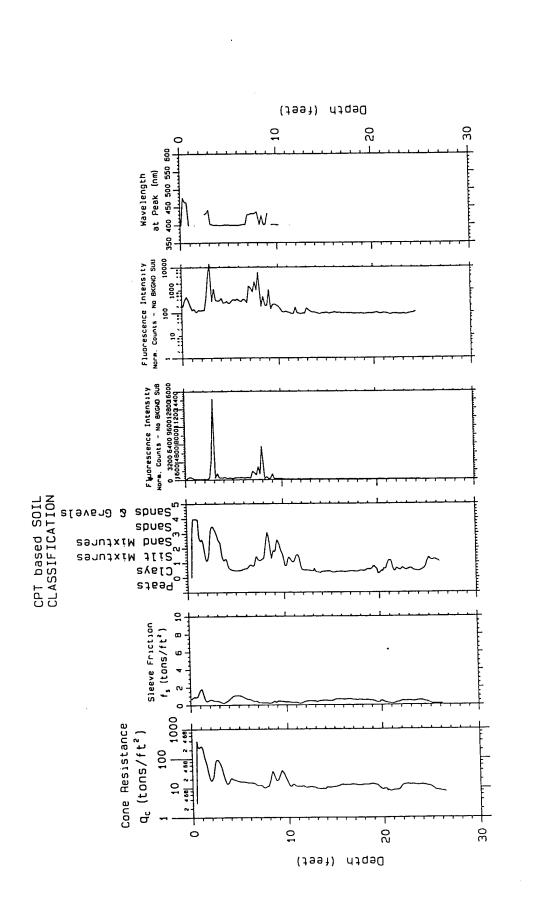
CPT; 8EAK01

U.S.Army Engineer District Kansas City

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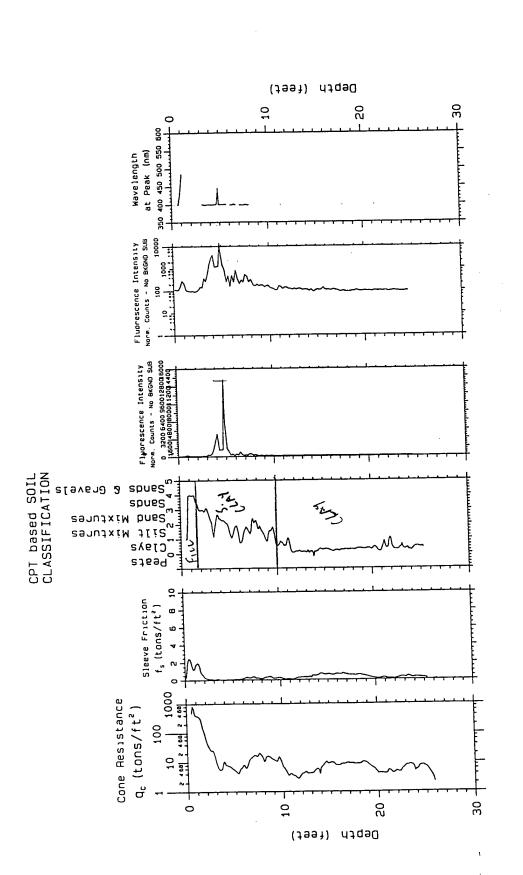
26.55 Eaker AFB Probe Depth; Project;

Site Characterization and Analysis Penetrometer System

CPT; 10EAK01

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Laser induced
fluorescence
of POL via



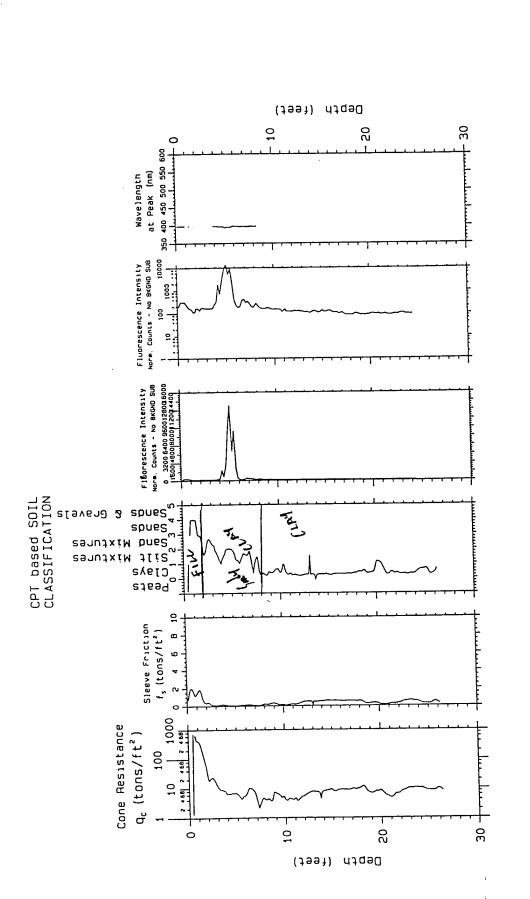
26.62 Eaker AFB Probe Depth; Project;

Laser induced fluorescence of POL via fiber optics

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U.S.Army Engineer District Kansas City Geotechnical Branch

11EAK01 Site Characterization and Analysis Penetrometer System



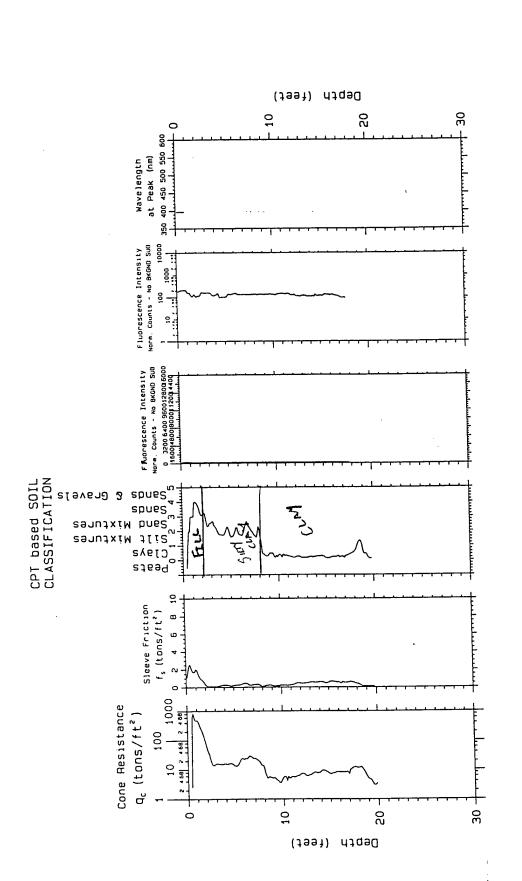
Eaker AFB 26.49 Probe Depth; Project;

CPT; 12EAK01 Site Characterization and Analysis Penetrometer System

U.S.Army Engineer District Kansas City

Laser induced
fluorescence
of POL via
fiber optics

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20.05 AFB Eaker Probe Depth; Project;

Characterization CPT.
and Analysis
Penetrometer System

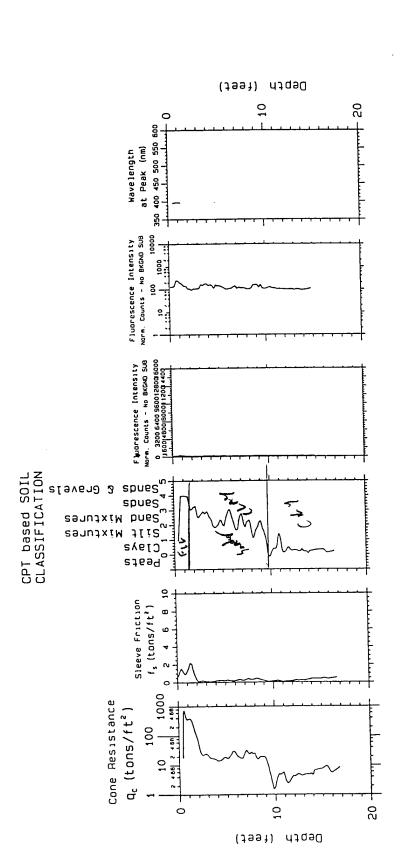
13EAK01

Probing date; 03-25-1995

U.S.Army Engineer District Sansas City Geotechnical Branch

Laser induced
fluorescence
of POL via
fluor optics

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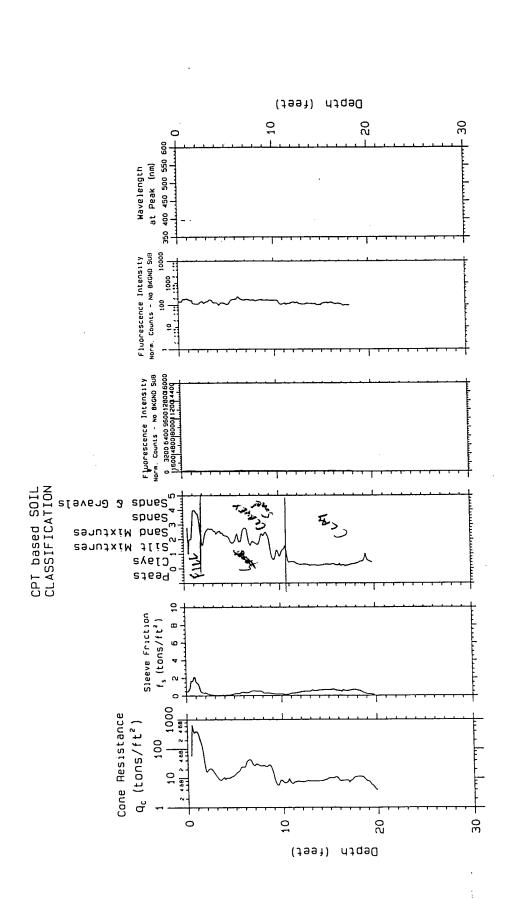
Eaker AFB 17.04 Probe Depth; Project;

Site Characterization and Analysis

CPT: 14EAK01

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Laser induced
fluorescence
of POL via
fiber optics



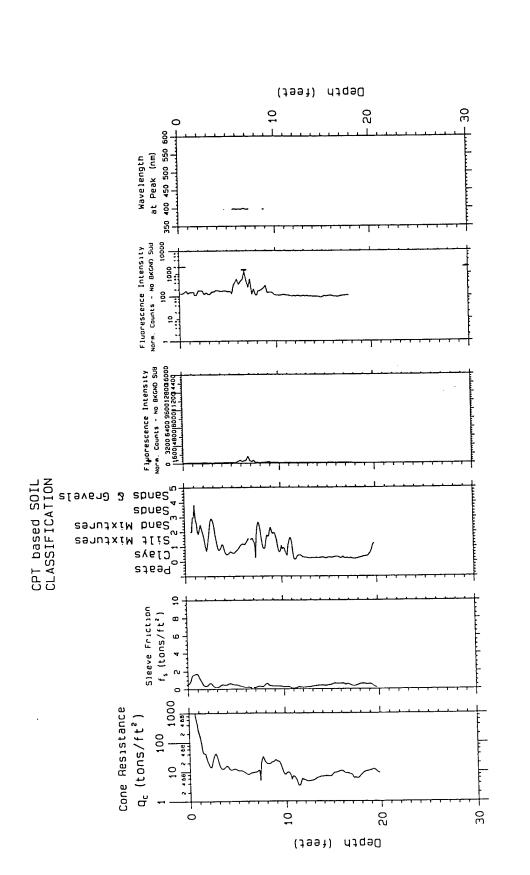
20.12 AFB Eaker Probe Depth; Project;

15EAK01 Site Characterization and Analysis Penetrometer System

Probing date: 03-25-1995

Laser induced
fluorescence
of POL via
fiber optics

U.S.Army Engineer District Kansas City Geotechnical Branch



Eaker AFB 20.05 Probe Depth; Project;

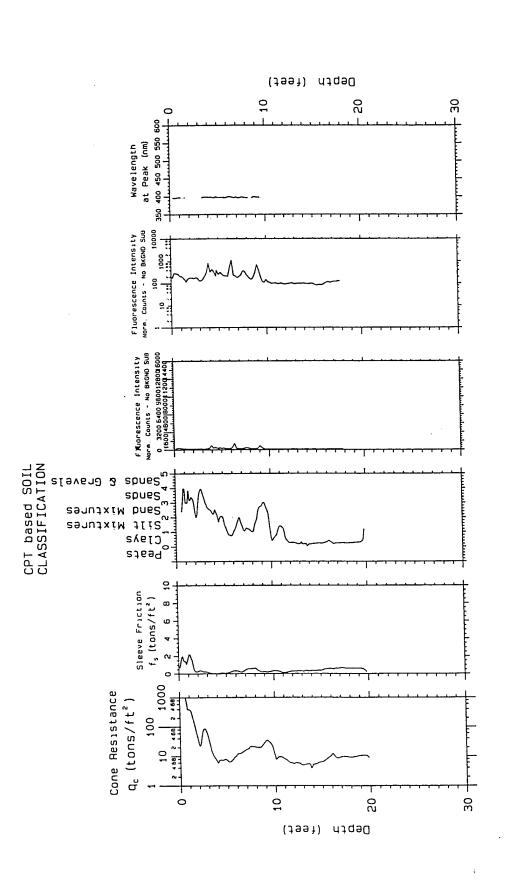
CPT; 16EAK01 Site Characterization and Analysis Penetrometer System

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Laser induced
fluorescence
of POL via
fiber optics

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Eaker AFB Probe Depth; 20.03 Project;

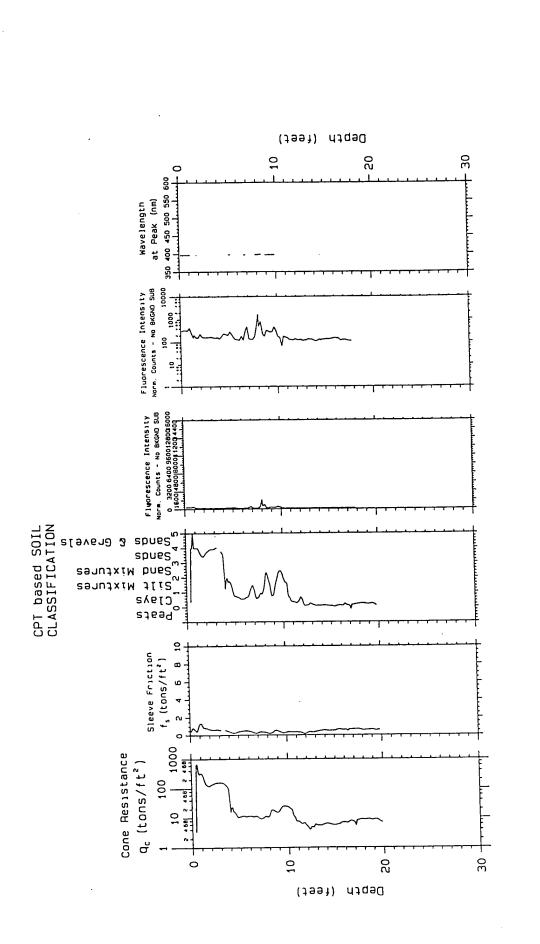
U.S.Army Engineer District Kansas City Geotechnical Branch

Laser induced
fluorescence
of POL via
fiber optics

Probing date; 03-25-1995

Site Characterization and Analysis Penetrometer System CPT;

17EAK01



20.09 Eaker AFB Probe Depth; Project;

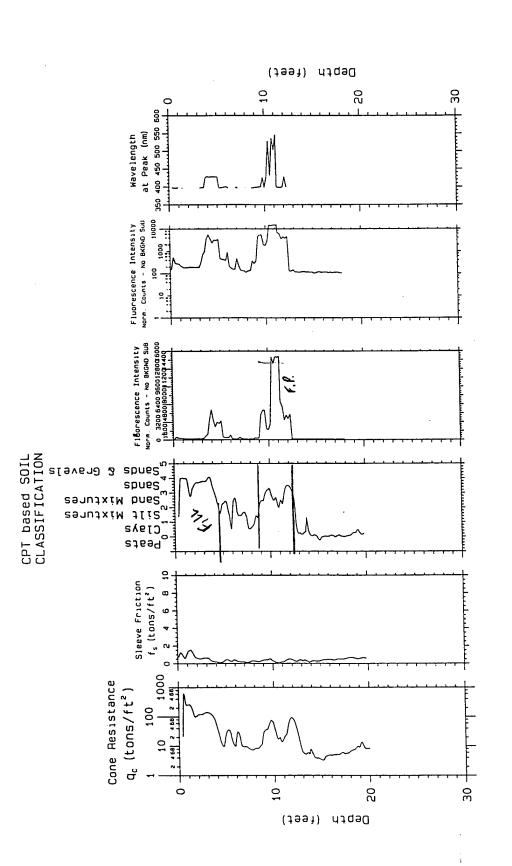
Site Characterization and Analysis Penetrometer System

18EAK01

Laser induced
fluorescence
of POL via
fiber optics

U.S.Army Engineer District Kansas City

dat



20.12 Eaker AFB Probe Depth; Project;

Laser induced fluorescence of POL via fiber optics

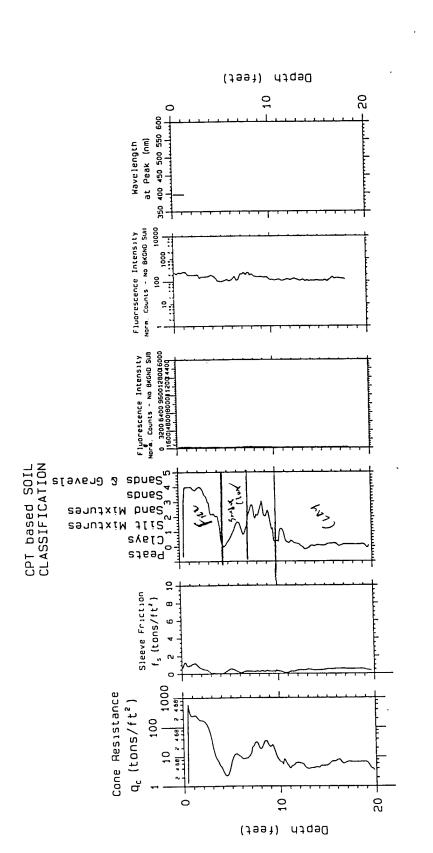
U.S.Army Engineer District Annsas City Geotechnical Branch

Probing date; 03-25-1995

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Site Characterization and Analysis Penetrometer System CPT;

19EAK01



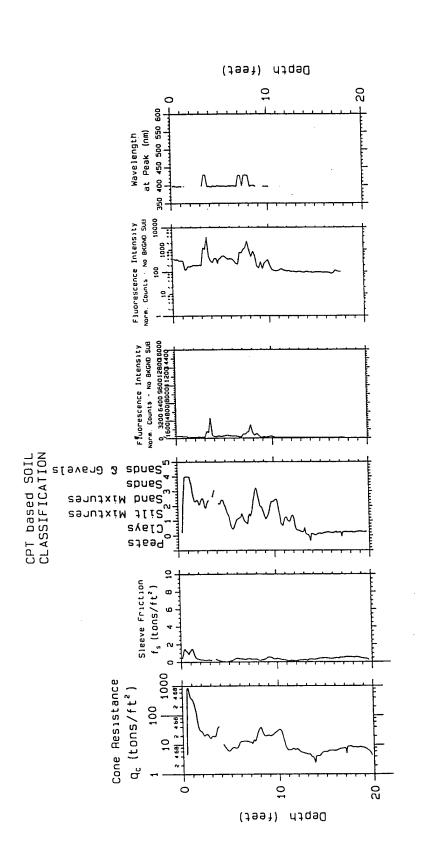
19.97 Eaker AFB Probe Depth; Project;

Site Characterization CPT; 20EAK01 penetrometer System CPT;

U.S.Army Engineer District Rassa City Geotechnical Branch

Probing date: 03-25-1995

Laser induced
fluorescence
of POL via
fiber optics

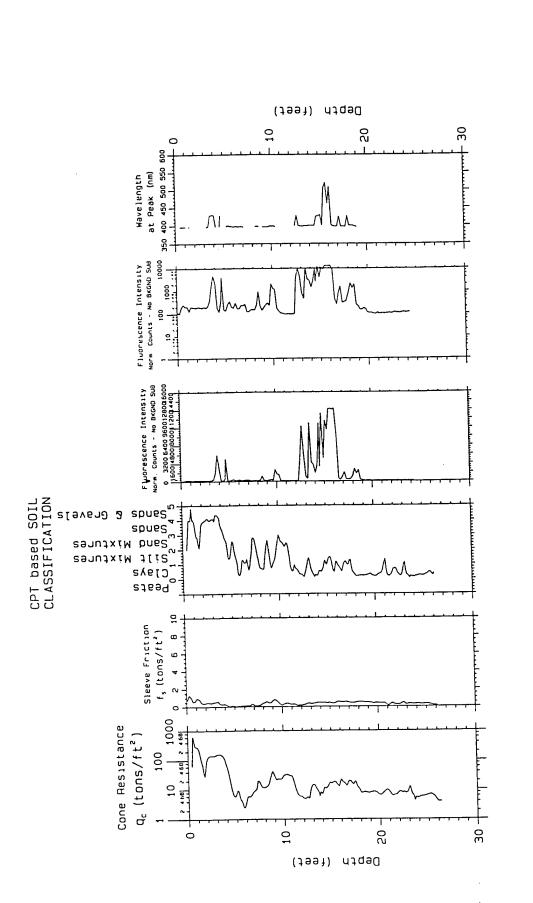


19.93 Eaker AFB Probe Depth; Project;

U.S. Army Engineer District Kansas City Geotechnical Branch

Laser induced
fluorescence
of POL via
fiber optics

Site Characterization and Analysis Penetrometer System



26.46 Eaker AFB Probe Depth; Project;

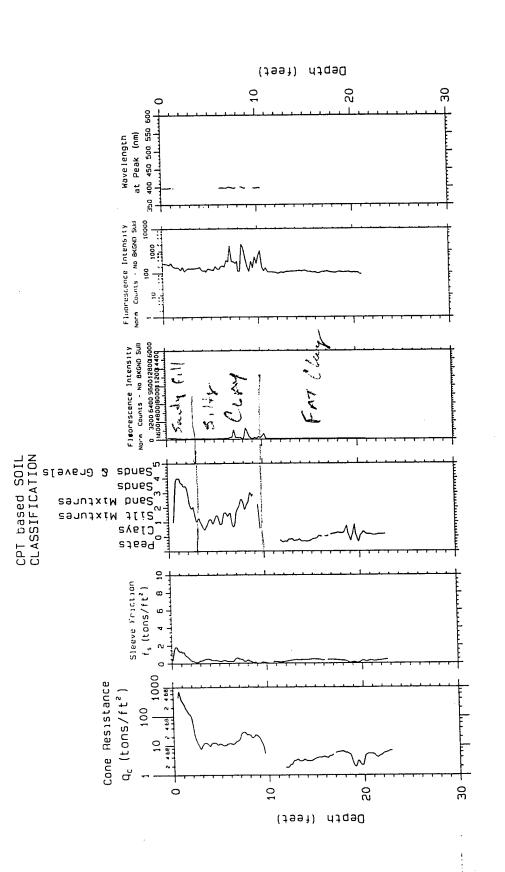
Site Characterization and Analysis Penetrometer Syste

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Laser induced fluorescence of POL via fiber optics U.S.Army Engineer District Kansas Ci

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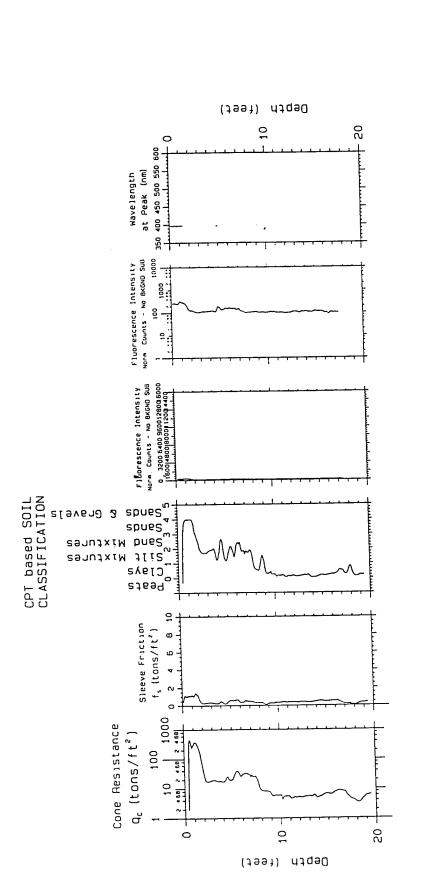
23.07 Project; Eaker AFB Probe Depth;

U.S.Army Engineer District Ransas City Geotechnical Branch

Laser induced
fluorescence
of POL via
fiber optics

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Site Characterization Characterization CPT; 23EAK01 Penetrometer System CPT; 23EAK01



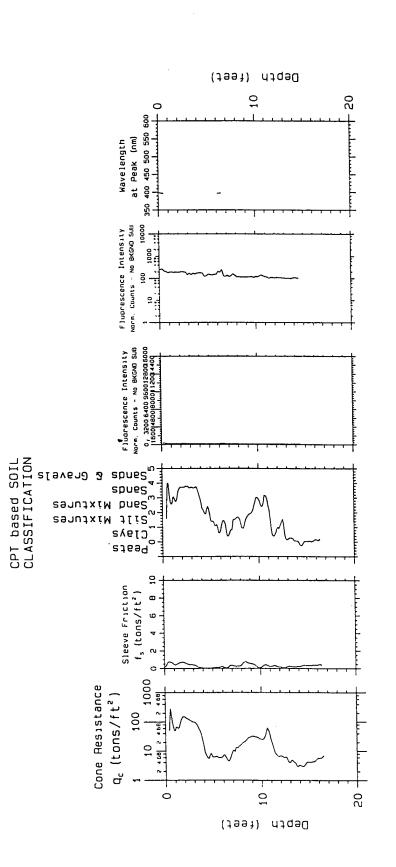
19.69 Eaker AFB Probe Depth; Project;

Site Characterization and Analysis Penetcometer System

3PT; 24EAK01

Laser induced
fluorescence
of POL via
fiber optics U.S.Army Engineer District

3



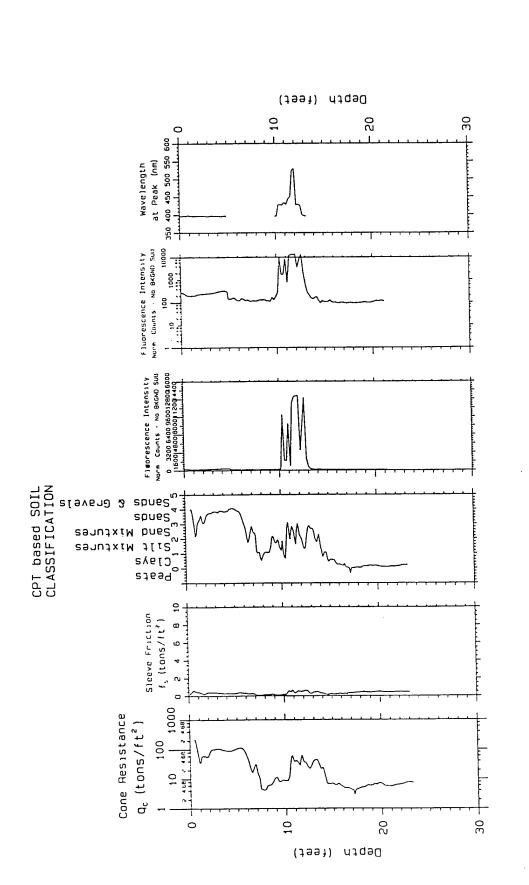
Project; Eaker AFB Probe Depth; 16.65

Laser induced
fluorescence
fluorescence
fluorescence
fluorescence
fluorescence
fluorescence
fluorescence
liber optics
District
Ransas City
Geotechnical Branch

Probing date; 03-25-1995

S Branch

Characterization CPT; 25EAK01



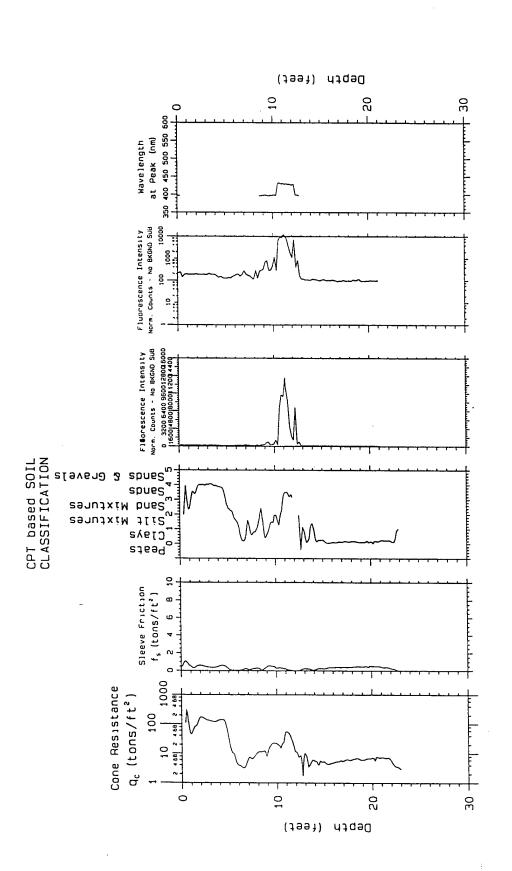
Eaker AFB Probe Depth; 23.40 Project;

U.S. Army Engineer District Ransas City Geotechnical Branch

Probing date: 03-25-1995

Laser induced
fluorescence
of POL via
fiber optics

Site Characterization CPT, 26EAK01 Penetrometer System CPT, 26EAK01



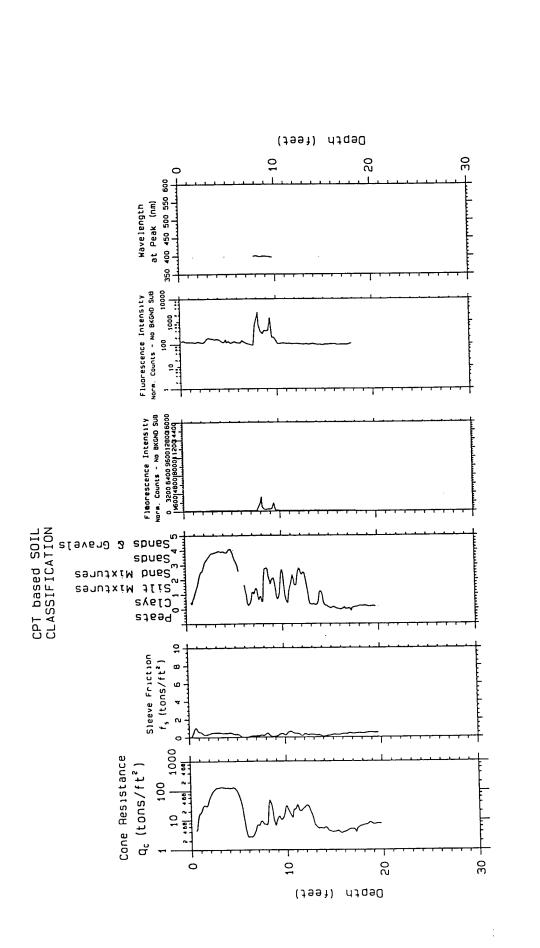
23.18 Eaker AFB Probe Depth; Project;

Characterization Characterization Characterization Character System CPT; 27EAK01

Probing date; 03-25-1995

U.S.Army Engineer District Ransas City Geotechnical Branch

Laser induced fluorescence of POL via fiber optics



20.05 Eaker AFB Probe Depth; Project;

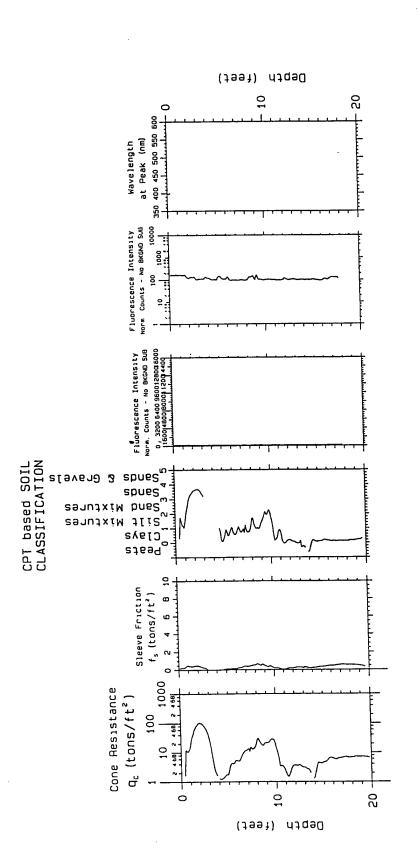
Site Characterization and Analysis Penetrometer System

28EAK01

U.S. Army Engineer District Kansas Ci

Laser induced fluorescence of POL via fiber optics

dat



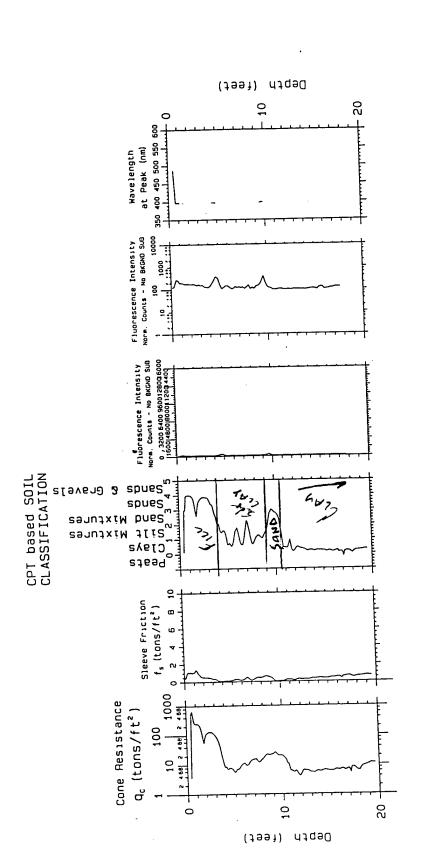
Eaker AFB 19.91 Probe Depth; Project;

Site Characterization and Analysis penetrometer System CPT;

29EAK01

U.S.Army Engineer District Kansas City Geotechnical Branch

Laser induced fluorescence of POL via fiber optics



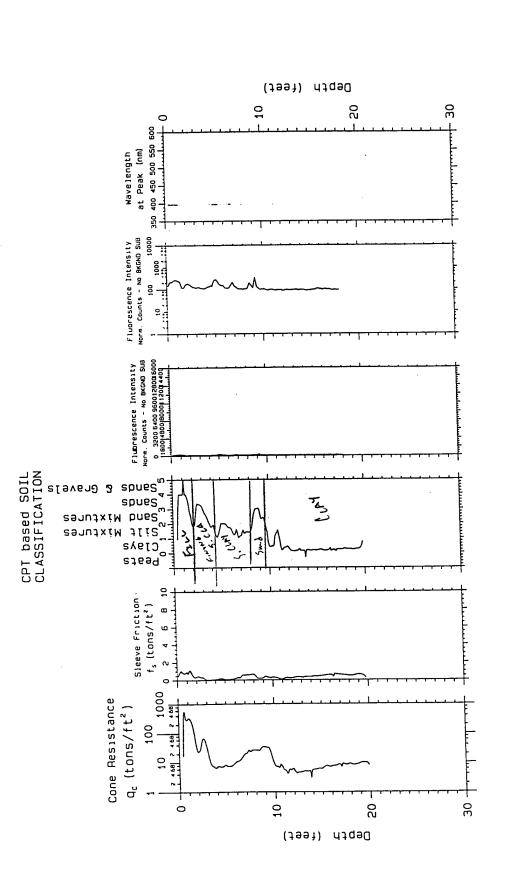
19.76 Eaker AFB Probe Depth; Project;

CPT; 30EAK01 Site Characterization and Analysis Penetrometer System

U.S.Army Engineer District

Probling date, 03-25-155

Laser induced
fluorescence
of POL via
fiber optics



20.12 Eaker AFB Probe Depth; Project;

Laser induced fluorescence of POL via fluer optics

U.S.Army Engineer District Ransas City Geotechnical Branch

Characterization CPT; 31EAK01 penetrometer System CPT; 31EAK01